



SATURDAY, JULY 8, 1871.

## Contributions.

### AN AMERICAN ENGINEER IN ENGLAND.

*Details of the Arrangement of the "London Road Station" at Manchester—A Peculiar First-Class Carriage on the Great Northern Railway.*

The London Road Station in Manchester is jointly occupied by five companies, or from it trains depart toward five main lines, viz: the Manchester, Sheffield & Lincolnshire, running nearly east and west from Manchester, and the Great Northern, the Midland, the London & Northwestern, and the Great Western, and these four may be said, speaking generally, to run from London in a northerly direction, the Great Northern being farthest east, and the Great Western farthest west. There are other important divisions of these lines, but they need not be noticed in this connection.

This station in Manchester has many interesting features of detail, common to other stations of less importance, and it may, therefore, be described as giving, perhaps, some insight into the arrangement of others.

The station building proper is about 200 feet wide and 400 feet long, and it is covered by a roof in two spans of 100 feet each, the center being supported upon heavy columns for the whole length of the building.

In front of this station building is another, closely adjoining it, which is three stories high and is occupied by the general offices of one of the companies, the Manchester, Sheffield & Lincolnshire. The front or office building extends across the whole width of the station building, about 200 feet, and is about 60 feet deep in the direction of the length of station building.

The entrances to the booking offices and the train platforms are through this office building, and, indeed, the whole of its ground floor is occupied by the useful waiting rooms, luggage rooms and entrance and exit passages, and the general offices are entirely in "the second and third stories," as we say in the United States, or on "the first and second floors," as they say in England, or "up one stair and two stairs," as they say in some parts of Scotland.

An incline or road slightly ascending towards the station affords access to it from one of the chief streets of the town, which bounds one side of the station premises, and by bringing the track on a viaduct of brick arches across the streets and the intervening blocks, this station has been placed within the very center of the town. This incline is 450 feet long, and the paved roadway at the entrance to the station premises is 30 feet wide, but it increases in width to the top of the incline, where it is 60 feet. The actual rise of the incline from the entrance gate up to the station may be 12 feet, but as the street passing by the side of the station has a down grade of about the same inclination, the height of the tracks from the streets beneath them is here from 20 to 25 feet. In some towns the steepness of these incline approaches is much greater than at this station, and it is generally determined by the area of the ground which can be secured for the station premises, and the profile of the part of the city or town through which the line must be brought to the station. In many cases no land whatever can be had for an incline, and hardly enough for the necessary switches or side tracks, and in such cases flights of stairs are built by which access to the train platforms is obtained.

At this London Road Station a level space some 60 feet wide is left across the whole front of the office building, at the head of the incline, where cabs may stand, and wait, if necessary, when bringing or carrying away passengers. Near the center of the wide open space thus left in front of the station a well has been built, through which, by a flight of steps, access to the station premises may be had more readily from one of the streets passing through the arches underneath than if the passenger were compelled to walk to the gate and come up by the inclined road, a distance of some 700 feet. On each side of the paved incline is a flagged foot walk 10 feet wide, and on the side toward the street this foot-walk is guarded by an iron fence 8 feet high, set upon a stone base and surmounted by gas lamps with ornamental globes. On the other side of the incline the adjoining premises are used partly for business purposes and partly for the goods trains of the railway. A brick wall with stone coping has been built at this side of the approach to the station, and in

this wall are sunk panels in which are pasted the time tables and special arrangements of the companies made from time to time, which may thus be very conveniently consulted by passengers approaching the station.

A glazed roof projects twenty feet from the front of the office building over the stone walk, and the outer side of this roof is supported by iron columns placed far enough in front of the ledge of the walk to allow cabs to drive under the roof for shelter while passengers alight from them.

Three of the companies which jointly use this station start their trains from a departure platform at one side of the station building, and the other two from the other side, so that on each side on the ground floor of the office building are arranged complete sets of rooms for parcels, refreshments for passengers who may be waiting, and for the booking or ticket offices.

Through the center of the office building passes the paved roadway, eighteen feet wide, over which cabs go to their usual waiting places by the side of the arrival platforms, and this entrance is closed, when necessary, by ornamental wrought iron gates. On each side of this roadway, through the office building, are flagged walks, by which access may be had to the stairways leading to the general offices in the upper stories.

This office building is thus divided, on the ground floor, into halves, and in the center of each half is a hall or room, opening both toward the train platforms in the station building and toward the inclined road by which passengers approach the station. From this hall the waiting-rooms open for the different classes of passengers, and also the rooms for storing luggage and for the reception of parcels, (all packages or bundles are here technically known as parcels, and "express" business is all done by the "parcels delivery" system of the railways.) In the middle of each of these halls, and at the end nearest to the train platforms, the booking offices are placed, in a long, narrow enclosure, so that access may be had to ticket windows on each side and at the ends.

One of the principal waiting-rooms is so neatly fitted up and furnished that a somewhat detailed description may be of interest. This room is 20 feet by 28 feet and about 21 feet high. It may be entered by two doors, one of which, however, appears at present to be unused, and on the side opposite these doors two windows are placed, each about  $4\frac{1}{2}$  feet wide and 10 feet high. These windows have an arched top, and each sash has a single piece of glass, about 4 feet by 5 feet. Curtains mounted upon rollers are fitted to the windows, and the walls are painted of a plain buff color. All the wood-work about the doors and windows is grained, and on the floor, in front of the lounges or benches that are placed at the sides of the room, are laid pieces of oil-cloth of a plain pattern.

In one corner is fixed a wash basin, and near it is a roller for a towel, although at this moment the towel is missing. At one end a grate is set, with a stone frame and mantel piece, and right above it is a plate glass mirror 4 by 5 feet. Near the wash basin is an ornamental iron hat and umbrella stand. One of the lounges is placed between the doors, one 14 feet long at the end opposite the grate, and under the windows are two, each 10 feet long, all being made without any arm pieces, and with padded and leather-covered seats and backs.

In the centre of the room, under the gas-burners, is placed a solid mahogany table, with polished top, 5 feet by 9 feet, and a similar table of smaller size is placed in one corner. There are six solid mahogany chairs in the room, of a very substantial description, with padded and leather-covered seats. On the walls are various railway announcements, and the effect of the whole may be pronounced very satisfactory both as to neatness and permanence.

This room is assigned to the use of first-class passengers only; but it is fair to say that one of the rooms devoted to third-class passengers is fitted up with an equal degree of painstaking, the chief difference in appearance being only that due to the use of the room by a very much greater number of passengers.

It has already been mentioned that a departure platform is placed on each side of the station building, and the arrival platforms are toward the center. A paved road 40 feet wide, 20 feet on each side of the row of columns that support the center of the roof, runs the whole length of the station, and on each side of this 40 feet road is a stone platform 15 feet wide, at which the trains arrive. The cabs are drawn up in line at these platforms so that a passenger may step out of any part of the train, except, perhaps, the back end of a long train, and find a cab close at hand if he requires it. This arrangement of bringing the cabs within the station building to take up passengers is very common,

and quite universal when, as in this case, the building is entirely upon arches above the street level and no entrance or exit whatever can be had through the sides.

It appears to be the usual custom to have certain cabs definitely assigned to a particular station, and often the name of the station is painted upon the cab; but of this more may be said at another time.

The departure platforms are 20 feet wide, and between them and the arrival platforms are laid four lines of rails, the center tracks being used for the temporary storage of carriages, and to some small extent for making up trains. The width of the space thus occupied by the tracks is 100 feet in all, or 50 feet for each set of four on each side of the building. Turn-tables have been placed in these tracks near the inner end of the station to facilitate the transfer of carriages from one track to another; and in the stone platforms opposite the turn-tables a recess is made and floored over with a timber frame, which is so arranged that when a carriage is to be turned for transfer on one of the tables, this frame may be pushed back from the table and the recess left open, thus giving clearance enough for the end of the carriage and the buffers as it is turned upon the table.

It appears, however, that it has never been found necessary to use these turn-tables here, so that the carriages simply run across them.

The side walls of the station are built chiefly of the pale yellow brick, but at the base a few feet are of red brick. The arches over the tops of the windows are turned with red and black brick alternating with each other. The windows are 5 feet wide and about 9 feet high, and the glass is in panes  $2\frac{1}{2}$  feet square, one of these panes in each window being arranged to swing open. The window sills are about 5 feet above the platform level.

On one side the track from which trains depart has been made some 80 feet shorter than the others, apparently to make room for an office apartment for the agent of one of the companies which has no principal office on these premises.

There are also rooms for trimming and storing the numerous lamps required for the carriages, and the inevitable accommodation "for gentlemen," which here is less efficiently cared for than at many other places. W. H. Smith & Son, the widely known newspaper and book sellers to all the leading railway lines, have on each side of this station their stands for the sale of all sorts of reading matter, placed at the end of the tracks, and right behind the buffers, which stop any carriages that may be pushed too far. Near these newspaper stands are placed small rooms for the sale of excursion tickets, their use being apparently to aid in supplying a rush of excursionists with tickets with the least possible delay.

The buffers, which are placed at the end of each of the eight tracks in this station, are of timber 12 inches square. Two posts are set upright, one opposite each buffer, and behind these a timber is placed at the same height as the buffers, projecting far enough on each side to receive an  $1\frac{1}{2}$ -inch bolt, which is about 15 feet long, and which passes obliquely downward by the side of the rails to some suitable anchorage under the sleepers. In front of the upright posts another cross timber is placed, at the same height as the first, and on the face of this timber are placed two pieces of hard wood, 5 inches or 6 inches thick, to receive any chafing that may be caused by the collision of carriage-buffers. These are all firmly bolted together, and the upright posts are fixed in some suitable sill or plate underground. At one station in Glasgow pieces of rubber are fixed to take this chafing, 12 inches by 16 inches by  $2\frac{1}{2}$  thick, and in some stations the usual iron spring buffer is fixed in the same way as it is on the carriages themselves.

The platforms are all laid with stone slabs, about 4 feet by 6 feet and 4 inches thick, and the height of them at this station is such that two steps must be made to get into the carriage, the first upon a small iron step fixed in front of each door of the carriages, and the second upon the floor of the carriage itself.

At about the middle of the length of the departure platforms a rack is built against the wall to contain the painted signs which are placed on each carriage, in nearly all the trains, while preparing for departure, to show their destination. These signs are generally black with white letters, and are removed by the porters just before the train starts. Many carriages, however, run continuously between certain stations, and on them the destination signs are permanently fixed. At several points on the departure platforms wooden seats are placed for those who may be waiting. These platforms are lighted by large gas lamps, 50 feet apart, supported by iron brackets projecting from the wall, the lamps



being about 1 foot square at the bottom, 2 feet square at the top, and 2 feet high. In the middle of these platforms a large illuminated clock is placed, with dials facing each way, and supported by an ornamental bracket. The arrival platforms are lighted by lamps 20 feet apart, hanging from the roof, each with two burners, and all held from swinging by wires suitably fastened.

At the end of the station at which the trains pass out a light lattice foot-bridge has been erected, by which "passengers are earnestly requested to cross the line," but which is little used, for the reasons that few persons need to cross at all at that end of the station, and because those few prefer, when the passing of trains will admit of it at all, to run the risk of walking over the tracks.

The roadway which extends through the center of the station is continued beyond the end, and rises to a platform level with the floors of the wagons or boxes in which carriages or horses are conveyed, so that both may be loaded with the greatest convenience, while the wagons stand upon the side tracks which are here laid between the main lines entering the station.

Here also the wagons (there are no "cars" on English lines, the vehicles being carriages and trucks or wagons) that bring milk are unloaded, and here also are brought sometimes the great vans in which furniture and many kindred articles are sent in bulk. That is, the van, which is usually a wide, low, covered wagon about 20 feet long 7 feet wide and 6 feet high on ordinary small wheels, is loaded at the door of a dwelling house, or any similar place, drawn by horses to the station, placed upon the railway wagon, at the platform just mentioned, and sent to any point reached by connecting lines, when the van may be drawn by horses hired on the spot to any place required.

One of the compartments in a Great Northern first-class carriage, running from this station, undoubtedly of very recent construction, is in its inside dimensions 6 feet 6 inches long, 7 feet 6 inches wide, 6 feet high at the side and 6 feet 6 inches in the center. The clear space between the seats is 22 inches, the door being 23 inches wide, and the seats 18 inches high to the top of the cushion. The glass in the sliding window of the door is 17 inches wide and 21 inches high, and the glass in the side windows is 12 inches wide and 26 inches high. On the inside of the lower part of the door is a thick, leather-covered padding, and the straps for holding the windows when open are fitted with large brass eyes, which slip over the brass pin to hold the window in any required position. On each side of the compartment are narrow arm-rests, and the padded arm-rests between the sittings are 8 inches wide under the hand. The sling straps that hang at each side of the door (in the real old coach style) have double loops instead of the more common single loop. The cords that are fitted for holding the chimney pot or "plug" hats of passengers are in this carriage of green and pink material, and run all around the corners of the compartment in the lining, which is some thin painted cloth material of a plain, neat color. There is an oil-cloth on the floor and on this a rug of brilliant color and soft texture. A stout strap is fastened near the lower edge of the door, to prevent it from swinging open too far.

#### What is Axonometrical Drawing?

TO THE EDITOR OF THE RAILROAD GAZETTE:

In your issue of June 3 there is an article on Axonometrical drawing, which must be unintelligible to any one but the writer of the article, who, moreover, must have coined the word for the occasion.

I venture to say that this kind of drawing is yet unknown to the generality of draftsmen.

As the writer expresses his willingness to give further information on the subject, I take the liberty of requesting him to do so for my own benefit and that of your other readers who are interested in "graphic art."

A.

#### LEVEL RODS.

WEST CHESTER, Pa., June 29, 1871.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In your issue of June 24, in an article on "Location in a New, Wooded Country," Mr. Burr speaks of a level-rod ten feet and a half long, divided to tenths and half-tenths, which he considers the best for the purpose. I have used for over three years on construction a similar rod, and am so well pleased with it on the score of convenience and economy that I think a description of it would be of value to others, especially as it can be made by any engineer and a good mechanic. It consists of a pine strip fourteen feet long, three inches wide, and about three-fourths of an inch thick, shod at the ends with iron. It is painted white and di-

vided along one face into two parts, the left containing the foot figures three-fourths of an inch long painted red, and the half-foot marks—small red lozenges—together with the tenth marks. The right hand division contains the hundredths of a foot, alternate black and white marks, one one-hundredth thick. These can readily be distinguished at a distance of four hundred feet, and the foot-marks farther, thus confining the errors to the leveler entirely, as no vane is required.

ALONZO P. JEFFERIES.

#### RAILROAD LAW.

*Negligence.—The right of a married woman to bring action for personal injuries in Illinois.*

In the case of *Mary A. Seymour vs. The Chicago, Burlington & Quincy Railroad Company*, recently tried in this city before the Hon. David Davis, of the Supreme Court of the United States, presiding in the Circuit Court of this district, and a jury, the charge of Judge Davis very concisely sets forth the law of negligence and contributory negligence as well as the right of action of married women for personal injuries in this State.

The facts in the case were as follows:

About ten o'clock in the forenoon of the 30th of August last, the plaintiff purchased of the defendant a passenger ticket from Chicago to Galesburg, and proceeded to the defendant's train of cars in the great Union Depot in this city. She had her baggage checked for Galesburg, and passed up the steps of one of the Pullman palace cars, intending to pay the extra fare for the right to travel in it. But she found the door of that car locked, and thereupon she passed across the platform of that car and into the car next to the palace car, laid down her shawl and basket and retraced her way to the door. Passing out upon the platform of that car she proceeded to pass to the depot platform for the purpose of finding the person who had the care of the palace car, that she might take a seat in it. As she was about to step from the platform of the car to the platform of the depot, she noticed some pieces of ice on her right, near to the palace car; and it seems there were other pieces of ice close to the steps of the car from which she was about to descend, and upon one of them she set her foot, slipped and fell, breaking one of the bones of her left ankle.

The plaintiff is a married woman, and has never been divorced from her husband, but during the last nine years supported herself, and she has not seen her husband in seven years.

It seems the Illinois Central Railroad Company are the owners of the depot where the accident occurred. The defendant insisted that the plaintiff was not competent to sue in her own name without joining her husband in the action. And that upon plaintiff's own showing she was not entitled to recover, because she saw some of the pieces of ice before she stepped off the cars, and that therefore she could have avoided that upon which she put her foot.

The charge of Judge Davis we give entire, as it is the law of the subject, as expounded by very high authority:

"That under the evidence of this case the plaintiff had the right to sue without joining her husband; and that railway companies who are carriers of passengers are required to use all the means reasonably within their power to prevent accident. It is not necessary to charge them with liability that they be guilty of great negligence. It is enough if the accident was caused solely by any negligence on their part, however slight, if by the exercise of the strictest care or precaution, reasonably within their power, the injuries would not have been sustained. But the company will not be liable, although guilty of negligence, if the injury arose from the want of ordinary or proper care on the part of the plaintiff, at the time of its commission; so that in this case the company would not be liable although the accident would not have happened if the ice had not been left on the platform, if the plaintiff, having seen that there were pieces of ice on the platform, could by reasonable care have avoided stepping on one of them; and it is for you to say whether this accident occurred to Mrs. Seymour in consequence of that want of reasonable care on her part, or whether, as she says, it was entirely the company's own negligence that produced it."

"It was the duty of the defendant to see that the platform used by it was safe and convenient for passengers to get in and out of the cars, regardless of any arrangement with the Illinois Central Railroad Company, who owned the building; and whether the ice was placed on the platform by the agents of the company or not makes no difference in this case, if the jury believe it was dangerous to persons going to or getting off the cars, and the cars were open to receive passengers. As soon as the cars were open to receive passengers, it was the duty of the employees of the defendant to have seen the ice and to have removed it. The agents of the company by opening the doors of the cars invited passengers to enter them, and in effect notified them that the platform was safe and free from obstructions for those who had purchased tickets to enter the cars."

"But the main question in this case relates to the inquiry, whether the plaintiff was in fault? The court does not instruct you, as a matter of law, upon the evidence, that the plaintiff was or was not guilty of contributory negligence, but leaves that fact to be found by you, under the rules of law stated by the court. Mrs. Seymour was obliged to use ordinary care and prudence in descending the steps and landing on the platform; and if at any moment it would have appeared to a reasonable and prudent person that there was risk of danger to herself in proceeding, then if she did proceed, it was at her own peril, even if the defendant was guilty of negligence. But if, on the other hand, taking all the circumstances of the situation together, there would not have appeared to a rea-

sonably prudent person any danger in descending the steps, and going on the platform, then she cannot be said to have been guilty of contributory negligence, though in fact injury followed from what she did.

"In deciding these points the jury will take into consideration the degree of light on the steps and platform; the time of day; the fact that she noticed pieces of ice and a wet spot on the platform, and the position she occupied when she first saw them. If the jury shall find from the evidence that the plaintiff contributed to the accident, they will find for the defendant. If, on the contrary, they find that she was not negligent, and the defendant was, then they will proceed to the question of damages; and on this they are instructed, they must give no more than will compensate for the injury, and cannot add anything by way of punishing the defendant. In estimating the extent of the compensation, they can take into consideration the loss of time sustained, the expenses attending the care of the injury, the length of time likely to occur before a permanent cure is effected, and the pain and suffering undergone by the plaintiff."

A verdict of \$2,500 was rendered for the plaintiff.

The right of married women to sue for personal injuries in this State, under the married woman's act of February 21, 1861, is further set forth by the Supreme Court in the decision in the case of the *Chicago, Burlington & Quincy Railroad vs. Leannah Dunn*, as yet unreported. The substance of this decision, so far as it directly relates to the right to sue for personal injuries, is shown by the following quotation from the opinion:

"The rule in construing remedial statutes, though it may be in derogation of common law, is, that everything is to be done in advancement of the remedy that can be done consistently with any fair construction that can be put upon it. Impressed with the force of this canon of interpretation, this court, soon after the enactment of this statute, not in terms, giving to the power to sue alone in matters affecting her separate property, held, to render the act operative and effectual for the purposes intended by it, it was indispensable she should have this right, and accordingly sustained an action of replevin brought by a married woman to restore to her the possession of personal property, being her own separate property, which had been seized by a constable on an execution against her husband. *Emerson vs. Clayton*, 22 Ill., 493. It was there said, this right to her property being vested in the wife, by the statute, it must, if the act is to be enforced, so remain until she consents to dispose of it, for this right includes full dominion over it. When, then, her rights are the only rights affected, on the established principles of law, she must bring suit for an invasion of them. The Legislature designed to make, and did make, a radical change in this respect, in the condition of a *femme covert*. Having the sole control of her property, there is no necessity of joining her husband in an action to recover it, or for trespasses on it."

"The very object of the statute was to keep her separate, out of the control of her own husband. If this was not so, the act would be futile and of no effect. The husband, for purposes of his own, might refuse to join in an action with his wife. He might connive with others to dispossess her of her property. The right of sole control over the separate property of the wife by her includes the power to do whatever is necessary to the effectual assertion and maintenance of that right."

"If then, it can be established that the right of action for this injury to the wife is property, as it came to her from a source other than her husband, and in good faith, then it was her separate property, and comes under the operation of the act of 1861. The statute is very comprehensive—all property."

"Chancellor Kent, in his Commentaries, says 'another very leading distinction in respect to goods and chattels is the distribution of them into things in possession and things in action. The latter are personal rights not reduced to possession, but recoverable by suits at law. Money due on bond or contract, damages due for breach of covenant, for the detention of chattels, or for torts, are included under this general head or title of things in action.' Comstock's Ed. 2 Kent Com., 432, under the head 'of the nature and various kinds of personal property.' A right to sue for an injury, is a right of action—it is a thing in action, and is property according to this authority. Who is the natural owner of this right? Not the husband, because the injury did not accrue to him; it was wholly personal to the wife. It was her body that was bruised—it was she who suffered the agonizing mental and physical pain. Indirectly, it is true, the husband was an injured party, also, during her disabilities, in deprivation of her comfort by reason thereof, and by further reason of his responsibilities for the charges for her care. For these, undoubtedly, he can sue and recover such damages as he may prove. Why is not this right of action property? Law commentators of distinguishing ability say it is, and with good reason, speaking according to well-recognized principles. It is true, it is a right which cannot be transferred to another, and dies with the person entitled to it; but it is none the less property in that person while living, which can be claimed so long as the bar of the statute of limitations cannot be interposed."

Would the purposes and objects of the act of 1861 be carried out, indeed, could they be, should this court hold, in view of the decision in *Emerson vs. Clayton*, that the wife could not sue alone for an injury to her person? Suppose she is slandered, and the husband chooses to pass the slander by, though he knows his wife is writhing and agonizing under its influence. Suppose she is assaulted and beaten, and the husband, for causes satisfactory to himself, but having no foundation in reason or justice, refuses to prosecute the wrong-doer. Can it be said the wife has, in both these cases, a property in the right of action the law gives; that it is her separate property, and that she acquired it during the coverture? It is conceded she may sue for an injury to her horse, being her separate property, or bring her action of trespass for despoiling her of an



earring, or any other personal ornament of value; but for grievous injuries to her person, she must await the consent of her lord and master. This is not, in our judgment, in accordance with the spirit of the act of eighteen hundred and sixty-one.

#### Trespass of Cattle—What constitutes negligence.

In the recent case of *Arnold vs. The Illinois Central Railroad Company*, the opinion of the Supreme Court of this State clearly sets forth the facts and the law, and is substantially as follows:

"The cow of the appellee, Arnold, was killed by a train of the appellant, where the road passes through the farm of one Thomas Snell. The cow had come upon his farm from the public highway, through an insufficient fence, and passed from thence on to the railway track through an open space designed as a farm-crossing, where the company had erected bars about a year before the accident. The bars, however, had been down and wholly neglected for three months. On these agreed facts the court gave judgment for the plaintiff below.

"If the bars had been taken down by the owner or occupant of the farm, and he had neglected to replace them, it might be urged with great propriety that his own acts would prevent a recovery in a suit brought by him. But in this it is immaterial whether the bars were taken down by the company or the occupant of the adjacent land. The company was guilty of negligence, under the statute, in allowing them to remain down for three months. The statute required the company to 'erect and maintain' a sufficient fence, and of this fence the bars were a part. *Great Western Railway Company vs. Helm*, 27 Ill. 199.

"It is urged, however, that the cow of appellee was a trespasser on the farm of Snell. But under the laws of this State, as long since settled by this court, cattle may go at large, and if they enter upon private property they are not trespassers unless such property is surrounded by a statutory fence. The fence in this case, between the farm of Snell and the highway, was admitted to be insufficient, and, in determining the rights of the appellee, they must be passed upon as if no fence whatever had been there. If there had been no fence on the highway it would hardly be contended that the company was not liable for allowing this opening in the railway fence to remain three months, and its track subject to be entered upon by all the animals remaining at large in the neighborhood, and a fence less than that required by law around the farm of Snell did not change the aspect of the case."

#### Pacific Railroad Company of Missouri vs. The City of Leavenworth.

The suit of the Pacific Railroad Company of Missouri, against the City of Leavenworth, having reference to the laying of the tracks of the road in that city, has just been decided in the United States Circuit Court of Kansas by Judge Dillon, in an opinion of which the following points are a synopsis:

1. Under the statutes of Kansas, a railroad company is prohibited to construct and operate its road upon the streets of an incorporated city, "without the assent of the corporate authorities."
2. Under this statute the city authorities are not limited to a simple granting or denial of the right of way, but they may prescribe conditions on which they will give their assent, and if these are lawful and proper and are accepted by the railroad company, they are binding upon the parties.
3. Accordingly where the right of way along the street was granted by a city on condition that the company should build a depot in a certain part of the city, and grade, riprap and pave the street, it used, and the company agreed to accept it on those terms, it was held that it could not hold and enjoy the grant and not comply with the conditions on which it was made.
4. An ordinance and contract special in their terms construed to give the city a right to re-enter and take possession of the street and remove the railroad track on the failure of the company to comply with the conditions of the ordinance granting to it the right of way.

#### Plymouth, Kankakee & Pacific Railroad Report.

We make the following summary of the report of James McGrew, President of this company, made to the stockholders on the 13th ult.

The company was formed by the consolidation of the Illinois corporation known as the Kankakee & Illinois River Railroad with the Indiana Company of the present name, on the 13th of December, 1870:

"About the middle of November last it became known to the officers of your company that there was likely to be some embarrassment upon the part of the Rock Island Railroad Company, in carrying out the contract that was made on the 22d of July last with the Pennsylvania and Rock Island Railroad companies, which companies were to take the bonds of this company and iron, equip and operate our road. In view of the delay and embarrassment that was likely to occur on the part of the Rock Island Railroad Company, it was agreed by all the parties to the contract that Oliver N. Barnes & Co., of New York, should be substituted as the party of the second part to the contract, instead of said railroad companies, which substitution was agreed to by your board on the 22d day of November, 1870, subject, however, to some modifications which were afterwards agreed to. A proposition was at once made to the Pennsylvania Railroad Company to assume the equipment and operating part of said contract, but the Pennsylvania Railroad Company, supposing that the embarrassment on the part of the Rock Island Railroad Company, before referred to, would prevent them from making a desirable running arrangement with the Pennsylvania Railroad Company, declined to assume the equipment and operating portion of Messrs. Barnes & Co.'s contract.

At this point your board met serious embarrassment. Parties in Indiana and Illinois, also, who controlled much of our local aid, were unwilling to go ahead until some further arrangement could be made for the equipping and operating of our road. None doubted that Messrs. Barnes & Co. could, with our road-bed built and the bonds of the company issued to them, build the road without difficulty; but they doubted their ability to equip and operate the road successfully with-

out some positive arrangement or running connection with some one or more of the great trunk lines that might with advantage be connected with our road. Under these circumstances it became a necessity that we, with Barnes & Co., make some such running arrangements with one or more of the great trunk lines referred to, before we could hope to secure a great portion of our local aid. As the Pennsylvania road had declined, supposing there was embarrassment on the part of the Rock Island Company, our only chance appeared to be in making such an arrangement with the Michigan Southern & Lake Shore Company. Negotiations were opened with that company, and a survey was made from Ligonier to Plymouth, which showed a very favorable line to build upon. In the latter part of January, Mr. Clark, President of the Michigan Southern & Lake Shore Railroad, requested your President to come to New York, and in the course of our negotiations Mr. C. requested your President to see Mr. Tracy, and learn of him if the Michigan Southern & Lake Shore Railroad Company would take a lease of your road, or arrange to equip and operate it, whether Mr. T. would make a fair and equitable running arrangement with the Michigan Southern & Lake Shore road. I saw Mr. Tracy, and his reply was that he would make a fair running arrangement with either the Michigan Southern & Lake Shore or the Pennsylvania Railroad Company. After this reply was had, a proposition was made to the Michigan Southern & Lake Shore Company, and the time for acceptance was limited to the 15th of February; but no decision was reached.

In the meantime, Gen. Cass reported to Col. Scott what Mr. Tracy had said as to his willingness to make a running arrangement with the Pennsylvania Company. Col. Scott said that if that was so, their company would take up the matter again, and make a contract to equip and operate our road. Upon this information, your President saw Col. Scott. A draft of a contract such as Col. Scott wanted Mr. Tracy to agree to was drawn up, submitted to Mr. S., and by him forwarded to Mr. Riddle, his Superintendent at Chicago. The necessity for care in the details of this contract, and the different interests involved, caused delay and several revisions, but at length an agreement was reached, and last week it was signed by Mr. Tracy, having been agreed to previously by the Pennsylvania Company.

In the meantime, the equipment and operating contract with the Pennsylvania was being negotiated; and that had, also, to be several times modified; but last week it was finally executed. The contract of Messrs. Barnes & Co., was then modified to meet the condition of things made necessary by having contracted with the Pennsylvania Company to equip and operate our road.

Under all the embarrassing circumstances heretofore referred to, your officers and Board of Directors have never faltered, but have kept the affairs of the company moving steadily along.

Soon after the contract for building and equipping the road was turned over to Messrs. Barnes & Co., bonds were obtained from Putnam County, and work at that end of our line has steadily progressed until the present time.

In February last your Executive Committee ordered a contract to be made for ties to be delivered along the line of the road in Indiana. This part of the work has been prosecuted with a good deal of vigor, and promises much in forwarding the enterprise.

In April your Executive Committee advertised for proposals for the grading, bridging, ties, etc., of the Indiana portion of our line, proposals to be received until the 25th of May. After the committee had learned the cash price at which this work was proposed to be done, they opened negotiations with some of the largest contractors for doing the work and taking their pay in lands, voted aid, personal subscriptions, and a portion of the first mortgage bonds of the company.

Such a contract was finally executed with Willard, Hawkins & Co., of Chicago, who are to grade, bridge, furnish ties and build the road-bed ready for the iron, from Plymouth to within ten miles of the Illinois State line, a distance of 55½ miles, and they are to receive for doing the work the lands, voted aid, personal subscriptions, \$50,000 of the stock of the company, and \$125,000 of the mortgage bonds, they taking the above specified amounts as their pay in full for said work, without any guaranty of the same on our part. If any portion of it fails they are to come forward and subscribe the amount so failing to the capital stock of the company, and take their pay for such amount in said stock.

The ten miles between the Illinois State line and that portion of the road covered by the Willard, Hawkins & Co. contract will be built by General Cass, who has already commenced work.

It was some time since apparent to your board that the local aid along the line of the road was not sufficient to complete the road-bed ready for the iron.

They, therefore, in providing for the issue of the first mortgage bonds, provided that the amount to be issued should be \$3,600,000, which is about \$250,000 more than is required to pay Barnes & Co. their \$20,000 per mile for ironing and finishing the road ready for the rolling stock. To this additional issue of first mortgage bonds Barnes & Co.'s consent has been obtained.

Bond have been engraved and printed to the amount of \$3,600,000.

A mortgage has been executed by the officers of the company to secure the above amount on the property and franchises of the road. This mortgage is now ready for record, and its proper form and validity as a sufficient security to the bondholders has been certified to by W. J. Howard and Theodore Cuyler, attorneys of the Pennsylvania Railroad Company.

A pamphlet has been prepared embodying a synopsis of the general railroad laws of Indiana and Illinois, charter of the Kankakee & Illinois River Railroad Company, articles of association in Indiana, articles of consolidation, form of bond and mortgage, statistics and other matter showing the business prospects of the road. Also a map showing our lines and its con-

nections from New York to Omaha. One thousand copies of said pamphlet have been ordered and will be out in a few days.

Your officers have gone forward with an unfaltering step, and with a determined will, that this enterprise must and should succeed, and they have been nobly sustained by your board. This steady and earnest moving forward of the work has undoubtedly had a very favorable influence in making the contracts heretofore referred to, and so indispensable to the success of the enterprise.

As a summary of the operations of the company since its organization, the following may be stated: Nearly all the right of way in Illinois has been secured and a large portion in Indiana. The remainder will be secured immediately. In Illinois over seventy miles of the road-bed is graded ready for the iron, and a large portion of the masonry for the bridges on that part of the line is finished. A very large number of ties are already delivered on the Indiana part of the line, and the balance will come forward as rapidly as needed. The whole line, except the grading between Streator and Dwight, some twenty-three miles, and the superstructures of bridges in Illinois, is under contract to experienced parties. A contract for equipping and operating the road has been made with the Pennsylvania Company, and a further contract for running arrangements with the Pennsylvania and Rock Island companies, which must prove immensely advantageous to the interests of your company and furnish it at once with the through business of two of the most extended and important east and west trunk roads in the Union, besides opening immediately a vast local trade, and diverting a large business from a dozen north and south roads which cross our line.

From the foregoing it will be seen that, with very slight exceptions, not only the building of your road-bed has been provided for, but contracts have been made for ironing and completing it ready for equipment; for equipping and operating it, and for very favorable running connection with the two greatest railroad corporations on this continent. Such full, complete and extensive negotiations bearing upon all the important interests of a new railroad is almost unheard of.

Your Board of Directors are glad to be able to report so favorable progress, and feel that we all have great reason for congratulation in view of what has been accomplished. The enterprise only requires to be followed up with the same zeal and earnestness that has characterized its management thus far in order to secure its full, complete and speedy consummation.

#### Tricks upon Patentees.

An outrageous black-mailing trick is still successfully resorted to, and should be understood by all inventors, especially those who apply for extensions or renewals of patents. The lawyer, in common with the public generally, having access to the records of the Patent Office, prepares a list of all the applications made for renewal or extension of patents, and files with the Commissioner a notice of protest on his own account. He then acquaints himself with the particulars of each case, and writes to the applicant that notice of a remonstrance has been filed here; that he has been employed by the persons whose interests are affected by the proposed extension to argue the case before the Commissioner; but that, as his clients are disposed to deal fairly with the applicant, he (the lawyer) thinks that the case might be compromised and the applicant saved much trouble and expense; he adds, perhaps, that a failure to settle the matter beforehand will probably result in refusal of the petition for extension. The lawyer is "not at liberty to name his clients," but will be glad to communicate to them any proposition which the applicant may make. If the inventor is timid, as is often the case, he will agree to buy off the imaginary remonstrant, and the black-mailing lawyer pockets the money. If, on the other hand, he feels sure of his case, and goes to great expense to collect evidence and present it in the strongest possible light, he finds, when he comes before the Commissioner, no opponent. One of these swindlers has made a large fortune in this way.—*Washington Correspondence of New York Tribune, June 19.*

#### Southern Coast Narrow Gauge.

A partial survey of this California 3-foot-gauge road has been made, and its general route is given by the *San Francisco Call* as running "from San Francisco to the coast, which it will strike about three miles south of Point Lobos; thence it will follow near the coast through the counties of San Mateo and Santa Cruz to the towns of Santa Cruz and Watsonville; thence running through the center of Monterey County, strikes the Salinas River at Los Coches; thence up the Salinas to San Miguel Mission and Paso de Robles. From this last named point it is not certain what route will be pursued, but probably the road will run through the San Luis or Van Ness Pass to the town of San Luis Obispo; from there to the Nipoma, and from that point by Foxon's to Santa Barbara, through the Santa Inez mountains. From Santa Barbara it will follow near the coast to San Buenaventura, and from there through the Santa Susana Pass to the head waters of Los Angeles River, in Los Angeles County, to the town of Los Angeles. From Los Angeles down the coast to Anaheim direct to San Diego.

"The Santa Barbara Standard, in speaking of this work, says:

"It will probably be intersected by the Memphis & El Paso road somewhere in the northern portion of Los Angeles County. We understand that the Memphis & El Paso road have offered the Narrow Gauge road ten thousand dollars per mile to lay a third rail on their track, so that they can pass direct through to San Francisco, and that this offer has been accepted."

—The New York & Harlem Railroad Company has declared a dividend of 4 per cent., free, for preferred and common stock, payable July 1.





PUBLISHED EVERY SATURDAY.

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## Editorial Announcements.

**Correspondence.**—We cordially invite the co-operation of the Railroad Public in affording us the material for a thorough and worthy Railroad paper. Railroad news, annual reports, notices of appointments, resignations, etc., and information concerning improvements will be gratefully received. We make it our business to inform the public concerning the progress of new lines, and are always glad to receive news of them.

**Inventions.**—Those who wish to make their inventions known to railroadmen can have them fully described in the RAILROAD GAZETTE, if not previously published, FREE OF CHARGE. They are invited to send us drawings or models and specifications. When engravings are necessary, the inventor is expected to furnish his own engravings, or to pay for them.

**Articles.**—We desire articles relating to railroads, and, if acceptable, will pay liberally for them. Articles concerning railroad management, engineering, rolling stock and machinery, by men practically acquainted with these subjects, are especially desired.

**Engineering and Mechanics.**—Mr. M. N. Forney, Mechanical Engineer, whose office is at Room 7, No. 73 Broadway, New York, has been engaged as Associate Editor of this journal in charge of these departments. He is also authorized to act as our agent.

## NARROW-GAUGE RAILROADS.

The discussion of the merits of railroad gauges narrower than 4 feet 8½ inches is apparently increasing rather than diminishing in interest. Companies for building narrow-gauge roads have been organized in every part of the country. The construction of some of them has been commenced, the lines of others located, and many more have been projected. The old maxim concerning making haste slowly seems to be disregarded, and the new plan of constructing railroads is adopted more because it promises so much than on account of anything which has thus far been accomplished thereby. If a narrow gauge possesses the advantages its advocates claim for it, then no word should be raised to oppose its adoption; but if, as seems to many thoughtful engineers, what is gained by placing the rails nearer together is very much overestimated, and the inconvenience resulting therefrom under-estimated, then it would be best for the facts to be known, in order that the inconvenience and loss, which must inevitably result from the introduction of new gauges, may be foreseen and prevented.

That many of the representations which are made in favor of the narrow-gauge roads are grossly inaccurate would be a very mild statement of the case. For example, a writer in one of the leading Western papers made the assertion recently that the cost of building and equipping railroads was in proportion to the cube of their gauges, according to which a road of 3-foot gauge would cost 3¾ times as much as one of 2-foot gauge; a 4-foot gauge would cost 8 times as much; 5-foot, 15¾ times as much, and a 6 foot road 27 times as much as one of 2-foot gauge.

That the writer did not understand the subject he was writing about is very obvious. There are, however, other statements which have been made which are not quite so wild, and, therefore, more plausible.

Nearly all the writers on the subject who advocate the narrow gauges begin by assuming that the dead weight of rolling stock is in proportion to the distance between the rails, i. e., that cars to carry the same load on a 2½-foot gauge will weigh only half as much as for a 5-foot gauge road. This fallacy has taken so firm a hold of the popular mind that it probably will not be corrected without the expenditure of large amounts of money, and as the result of the sober logic of experience and disappointment. Nearly all the arguments in favor of narrow gauges are based on the above assumption. If it is a mistaken one, then all the reasoning based upon it must fall. We will therefore endeavor, as plainly as possible, to show its mistake, and to do so

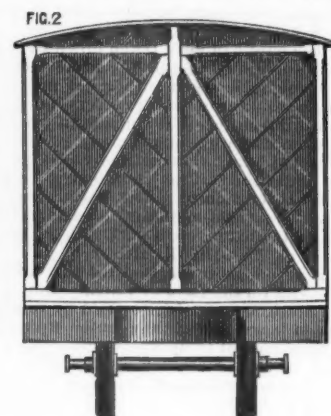
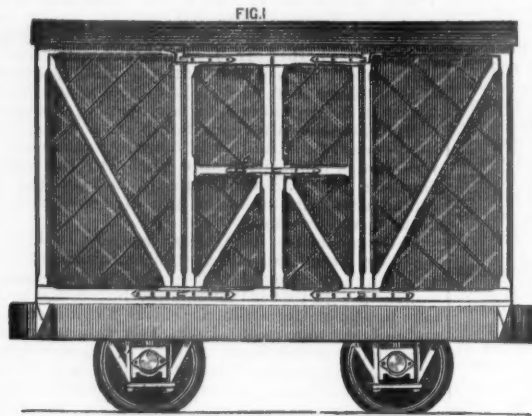
we have reproduced engravings, Figs. 1 and 2, of a narrow-gauge car designed by Mr. Fairlie, and which, he states, weighs 3,668 pounds, and will carry 11,200 pounds of freight, or three times its own weight. Now we will not question these figures, but we simply ask how much the weight of that car would be increased by lengthening the axles as shown in Figs 3 and 4. In every other respect the latter car is exactly the same as that for the 3-foot gauge.

As near as we can calculate from the engraving, the weight of the axles for the 3-foot gauge is 150 pounds, or a fraction over 4 per cent. of the weight of the car empty, or one per cent. of its weight when loaded. It will be observed that we have not taken into consideration the weight of the locomotives, which, if added

car carries double its weight of coal, while the latter only a little over one and a third times its own weight.

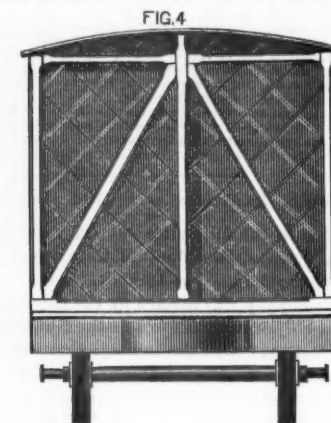
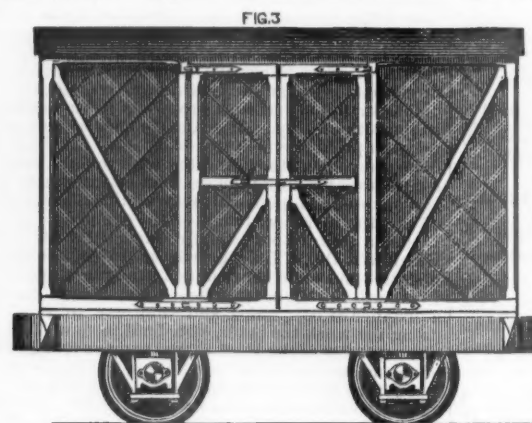
Now the writer in the *Tribune* has not only taken the weight of a four-wheeled car and compared it with those having eight, but he has taken the weight of a platform car—which is the lightest form it is possible to build—and compared it with an eight-wheeled box car, which is the heaviest kind of freight car used. Not only has he done this, but he has taken the maximum weight of such cars, the majority in use weighing nearly a ton less than he has stated.

It would be a very easy matter to build four-wheeled platform cars for 4-foot 8½-inch gauge roads which will carry 2½ times their own weight, especially if the speed at which they are to be run is reduced below that



to the weight of the cars, would make the increased weight of axles considerably less than one per cent. of the total weight of train. Of course, with bad management, or with certain kinds of traffic, many cars would be run empty, which would make the relative weight of axles somewhat greater, but even though one-half were run empty the increase of weight of cars resulting from widening the gauge would be less than two per cent. These calculations are based upon Mr. Fairlie's figures, and it must be remembered that in this country, up to the present time, no box cars have yet been built which will weigh so little and carry so much. There have been none made, of which we have any knowledge, which will carry double their own weight of freight, and we have made diligent inquiry to find them, and in the RAILROAD GAZETTE of March 4 we made a request of a firm who are among the leading contractors and

of ordinary freight trains. But the question comes up whether it is practicable or desirable to undertake to do the business of a road with cars of that kind. On nearly all the roads where such cars have been used for any other traffic than minerals they have been, or are being, abandoned. On the Northern Central they are now building all eight-wheeled cars. On the Great Western of Canada and the Eastern of Massachusetts there was formerly a considerable equipment of four-wheeled box cars. On both these roads they have been abandoned, and we are not aware of any road in the country which is now being supplied with cars without trucks for anything excepting mineral traffic, and even for that, in many cases, eight-wheeled, or, as our English friends term them, "double-bogie" cars are now made. If there is any advantage in using four-wheeled cars, they can be



advocates for the construction of narrow-gauge roads to furnish us with a drawing of such cars, but up to the present time we have had no response from them.

To illustrate the sort of argument which is based upon this alleged reduction in weight of cars, we have reprinted, on another page, a letter published in the New York *Tribune* of June 30. It will be observed that the weight of four-wheeled freight cars for the 3-foot gauge is given in the letter as two tons to carry five. Now the only cars we know of which have been built for a 3-foot gauge, in this country, of this weight and capacity, are four-wheeled platform cars. Now a four-wheeled car without trucks is much lighter in proportion to its carrying capacity than eight-wheeled cars with trucks. The reason of this is, that the truck-frames increase the weight of the eight-wheeled cars. In proof of this we will quote the weight of four and eight-wheeled coal cars on the Northern Central Railroad.

Four-wheeled coal cars weigh 5,000 lbs and carry 11,200 lbs. coal.  
Eight " " " " 10,300 " " 22,400 " " "

In general construction these cars are similar: both kinds are made of wood, and are what are known as "coal-hoppers"—the one of course having trucks and the other not. It will be seen that the four-wheeled

employed on a 4-foot 8-inch gauge just as well as on a 3-foot road; but that is a matter independent of the gauge and altogether a different question, and only makes the comparison of light four-wheeled cars for one road, with heavy eight-wheeled cars for the other appear more unfair.

The *Tribune's* correspondent also says that "statistics show that on the standard gauges more than four 'tons of dead or non-paying weight are annually carried over these roads to each ton of paying weight.' That this may be the case with some very badly managed roads is quite possible, but if he had taken the reports of the Fort Wayne Division of the Pennsylvania road—which he has selected for comparison—he would have found that instead of being as 4 to 1 on that road, it is only 1.49 to 1, and the Chicago, Burlington & Quincy shows the same, and the Cleveland & Pittsburgh only 1.08 to 1.

Notwithstanding these inaccurate statements, the letter which "S." has written is published in one of the leading papers of the country, and hardly a prominent journal in the land but has had some similar communication or editorial commending the narrow-gauge roads. Many amateur engineers have rushed into print, and Mr. Fairlie's paper of last fall has been quo-



ted until it is threadbare. The Festiniog road is constantly referred to as a proof or illustration of the soundness of the conclusions which have been drawn from false premises. Those who refer to it so much seem to forget the nature of its traffic, which is to a very great extent the transportation of slate, which can be carried on four-wheeled platform cars, which we have shown to be lighter than any other kind that can be built. We have no data at hand from which we can learn the speed at which this freight is carried on the Festiniog line, but any superintendent of a road which transports coal will say that at slow speeds it is quite practicable to use four-wheeled cars; but for fast freight trains, and especially on a rough road, they are unsafe. The narrow-gauge people constantly lose sight of the fact that the weight of rolling stock must increase with the speed, and that every additional convenience added for the comfort of passengers implies an increase of dead weight of cars. If travelers could be induced or compelled to ride in open four-wheeled cars, similar to some of those used on horse-railroads in summer, with no other protection from the wind and weather than curtains on the side, the dead weight would not exceed the paying weight, whereas some sleeping-cars weigh ten times as much as the passengers they carry. Between these two extremes there is every gradation of weight. The fact of introducing a longitudinal passageway through our cars increases the weight very materially above that of English cars without it. Double trucks, which are a necessity on our rough roads, water-closets, heating apparatus, double windows and doors, all increase the weight of cars. In Europe much of the freight is carried on platform cars and covered with tarpaulins, a practice which in this country would result in the damage or loss of much of the freight. A covered freight or box car necessarily weighs more than an open car, whether it is on a wide or narrow-gauge road.

The height of the passenger cars for the Denver & Rio Grande Railroad, from the inside to center of dome, is given as 7 feet 9 inches. This would leave the height under the eaves, very little, if any, more than 6 feet—not high enough for an ordinary man to stand up straight with his hat on. Now, if passengers will ride in cars of this size on ordinary roads, it will be a very easy matter to reduce the weight to less than 457 pounds of car per passenger, which is the proportion of those described for the Denver & Rio Grande Railroad.

It is said, too, that the passenger cars for this road give the same seating room as those on the Pennsylvania road. Let us see what the result will be:

	Inches.
Taking the width of seat at 19 inches .....	57
" " " aisle at 20 inches .....	20
" " " seat-arms at 2 inches .....	4
" " " sides of car 4½ inches .....	9
Total width of car .....	90

or 7 feet 6 inches. The almost universal practice is to make the width of cars not more than double the width of the gauge, yet these will either be 1 foot 5 inches, or 25 per cent., wider than the rule of ordinary practice would permit, or else the seat or passage way must be narrowed. It is, therefore, not surprising that the writer should say that "perhaps too much deference has been paid to 'prejudices in favor of existing patterns, to obtain 'the full benefit of the narrow-gauge system.' There is a 'prejudice' that a 19-inch man will not fit in a 16-inch seat, which we doubt whether the narrow-gauge people can overcome, unless they call in the aid of Mr. Banting's system to reduce corpulency.

With reference to locomotives, some very curious statements have been made, and from some of them the reader would be led to believe that the law of gravitation acted differently on narrow-gauge roads from what it does on those with the rails farther apart. Now if what is written on this subject was addressed only to an audience of engineers, perhaps no word of explanation would be necessary on this point, but most of the people who read the popular articles which are now so prevalent in our newspapers are not engineers, and therefore do not realize that the reason why a locomotive can draw a train is because of the adhesion or friction of the driving wheels to the rails. This friction is in proportion to the weight and entirely independent of the gauge. A locomotive with ten tons' weight on its driving wheels will have exactly the same adhesion on a wide that it has on a narrow gauge, so that to pull the same gross load the engines must weigh exactly the same if they are built on the same plan. A pound of coal, too, will generate just the same quantity of steam on a narrow gauge that it will on the wide, and we have yet to learn of a locomotive builder who will make engines of a given weight for one road cheaper than for the other. If there is any difference at all, they will take contracts at less prices for loco-

motives for 4-foot 8½-inch roads than for the narrow gauge, their capacity being the same. We also doubt very much whether most builders of cars would make any difference at all in the price of rolling stock, of the same character, size and capacity, for the one road and the other, so that what we hear about the reduction of the cost of rolling stock for the narrow gauge, if not a mistake, is a delusion.

We do not wish to be understood as asserting that a 3-foot gauge road may not be operated cheaply and do a fair business. What we assert is, that the advantages of the narrow-gauge have been immensely overstated, and that most of what is claimed for it is attributable to entirely different causes, which are just as available on an ordinary 4-foot 8½-inch road as on a 3-foot or narrow-gauge, and, moreover, that but very little positive knowledge exists in this country in relation to the construction or operation of such roads, and that thus far the advantages obtained are only hypothetical or, at best, experimental. That some very slight reduction in the cost of building and equipping roads would result from narrowing the gauge is true, but it is so very small, and the disadvantages resulting therefrom so very great, that the latter very much overbalance the saving in cost. Roads to do a light traffic at slow speed can be built, equipped and operated at very nearly the same cost without the inconvenience of a break of gauge, will give greater stability to the rolling stock, and have the enormous advantage in their favor, that when the business which is developed shall require it, the capacity of the road can be gradually increased by laying heavier iron to replace that which is worn out, and building larger cars and engines which will have greater carrying capacity.

Next week we will have something to say about the road-bed and its cost.

#### THE ST. CHARLES BRIDGE.

The importance of this work, and its value as furnishing engineering precedents in overcoming unusual difficulties, justify us in presenting the elaborate illustrations which appear in another part of this issue, and in giving a more extended discussion of it than appeared, at the time of its formal "opening," on page 114 of the present volume of the RAILROAD GAZETTE.

Its construction has occupied nearly three years, being commenced in August, 1868, and practically completed on the 23d of May, 1871. It is the longest iron bridge in the country, consisting of three "through spans" on the Fink plan, four "Fink suspension" spans and the iron viaduct approaches, making a total length of iron bridge of six thousand five hundred and thirty-five feet. The seven river spans vary in length from three hundred and five to three hundred and twenty-one feet. There were eight river foundations—most of them presenting new and extraordinary difficulties in construction—varying from fifty-four to seventy-six feet in depth, the caissons for which had to be carried down through alternate strata of quicksand, large boulders, and tangled masses of drift logs. Add to these submarine difficulties the facts that at the bridge site the Missouri River rises and falls forty feet; that its flood speed is nine and one-half miles per hour; and that drift islands drawing twenty feet of water, and which are more than three hundred feet in diameter, are not unfrequently carried past in the heavier freshets, and an adequate idea may be formed of the character of the work.

During the progress of the work, owing to an unusual freshet, the general direction of the current was suddenly changed. Four thousand feet above the site of the bridge a diversion of the current carried away one thousand four hundred feet of the south bank, and, curving outward and returning in the form of an S, brought its abrading force directly upon the south abutment. In this emergency, when the entire demolition of the abutment was threatened, Captain Smith devised and constructed a dike which so diverted the current as to reclaim a large tract from the river bed and confine the channel. The south abutment is now surrounded by dry land.

#### THE SUPERSTRUCTURE

is of the Fink and trellis, or double form, the latter modified by the omission of the usual counter-ties. The counter strains are taken by compression ties, extending a few panels on each side of the center, and consisting of two parallel plates stiffened by short diagonal braces of wrought iron riveted to the side plates and at the centers. The wrought-iron strut columns are secured to the chord by wrought iron suspension joints, so that they are equally available for tensile strains at points where such strains occur—thus dispensing with the center tie-rod usually found in this form of truss. The substitution of the peculiar ties at the center for counter-ties constitutes the essential dif-

ference, in mathematical construction, between this truss and the one used at Kansas City. Mr. Smith has also dispensed with the end panel used there.

The details—upon which depend the comparative cost and weight, and, indirectly, the ultimate strength—show many important features of novelty. A leading idea of the engineer has been to construct the bridge of as few pieces as possible. For instance, the upper chord is composed of a single cast-iron tube, of sufficient size to permit the passage of a small man through from end to end. The structure is fastened throughout by pin joints, thus avoiding all transverse strains. The cross-ties are placed directly upon rolled-iron girders placed between the chords proper, thus throwing all the bending strains upon parts not subject to either tension or compression, dispensing with the ordinary stringers and avoiding the bulky depth of flooring beams usually seen.

The Fink deck spans are proportioned to carry 2,350 pounds per foot, with the following stresses on the various parts:

Cast-iron chord.....	12,000 lbs. per inch.
Wrought-iron chain.....	12,000 " "
Quarter chain.....	11,000 " "
Eighth and sixteenth chains.....	1,000 " "
Posts (Phoenix column).....	6,500 " "
Laterals (of these there is a double system).....	8,000 " "

The chord is 2 feet in diameter, and the main post 21 inches.

The trellis spans are completely pin-jointed throughout, having both the rocker and roller action at the feet of end-posts, and all the posts and ties are pin-jointed, in the upper chord as well as lower. There are no adjustments in the web or chord systems. All the parts had to be, and are, exact as to length. The posts, which are Keystone columns, have wrought-iron heads and feet, webbed out so as to distribute the weight over 2½ feet in length of the pins on which they rest.

The truss itself is a "double triangular girder," with inclined end-posts, and no connection between the systems. The counter-brace action is secured by stiffening the middle ties and giving the braces a tensile connection. The floor-beams are composed of 12-inch channel iron, sandwiched with and forming part of the lower chord—the cross-ties being laid directly on these, without the interposition of a stringer. These girders are proportioned in the same manner as in the Fink, but to a working load of 2,400 pounds per foot. The weight of each Fink span is 680,000 pounds; of each trellis span, 788,000 pounds.

#### PLACING THE SPANS.

Probably the most dangerous work of all was the erection of these spans. As no false work could possibly stand at this point in the river, temporary piers were constructed, resting on piles, and surrounded by cribs 18 feet wide and 50 feet long, filled with stone. There were three of these piers in each span, and on these were placed, bodily, by means of powerful twin derrick boats, Howe truss spans, 80 feet each. On these spans was placed the false work proper, the top of which was 121 feet from the water.

During the winter of 1870-71, span No. 1 was swung, at noon, on a day when the break of the ice gorge above was imminent. Fearing this, the Howe trusses and their superincumbent false-work were bolted up to the span. During the night the ice went out, wrecking the crib piers beneath, but leaving the whole mass of false-work, including the Howe trusses, hanging from the span which one day before they had been carrying.

#### THE DIKE.

Perhaps the most interesting engineering feat was to capture and place under control the treacherous current of the river. Situated, as the bridge is, across a sharp bend, the effect of which was to cause the current, and with it the channel, to shift from side to side according to the state of the water, it was necessary to confine the channel between fixed points in order to so construct the bridge that it would not interfere with river navigation. This feat the engineer accomplished by building an immense dike, projecting, when completed, 700 feet from the south shore, and extending above the shore some 400 feet. The difficulties attending the building of this dike were peculiar, and we give in detail the method pursued and described by the engineer to whose skill the final success is wholly due. Out from the south shore a "pile wall" was driven, from which coarse riprap was thrown in, and an embankment made upon it, producing an eddy immediately below. In this eddy material could be deposited without danger of wash, and so the dike was carried forward in an irregular line, guided by the slack-water which preceded the bank in its progress down stream. This was continued until a space 700 × 400 feet, more or less, was enclosed by the wall meeting the shore below the bridge line. After being properly packed and



protected from wash, this immense coffer-dam, for such it now was, was pumped out, leaving the former uncertain bed of the river comparatively dry land upon which the pier could be erected without interference from the principal enemy—the river current. The dike was afterward built to such a height and so strengthened that its outer walls now form the south bank of the river at that point, thus effectually and permanently forcing the current to keep toward the north shore and to be confined within fixed limits. Although the cross section of the river is necessarily narrowed, it does not effect the velocity of the current; it being a well known fact of the regimen of this, as well as some other rivers with shifting bottoms, that obstructions placed in the current will certainly cause a scour sufficient to leave the same sectional area, and, consequently, the same capacity for discharge. Some idea may be formed of the power and uncertain nature of the stream thus controlled, from the fact that it is subject to rises of 40 feet, and scours of 45 feet deep. These scours frequently occur without perceptible effect upon the surface, and deposits form in the shape of bars that travel directly across the stream from side to side. In attempting to sink a caisson in two and one half feet of water, the scour under it was so rapid as to actually reach a depth of 32 feet before the caisson could rest upon bottom, sinking to that depth quite rapidly. This easy yielding of the bottom to the force of a stream of water was utilized frequently to clear away sand from around the edges of the caissons, and at pier No. 5 a large sand bar, many yards in length, was actually scoured entirely out of the way by the use of large jets of water driven at a high velocity.

#### FOUNDATIONS.

The bed of boulders found immediately below the shifting bottom, although more permanent in position, by their bulky and unyielding nature made the passage of the foundations through them very difficult. To drive a pile through them required an average of 3,000 blows of a 3,000-lbs. hammer, and, in some cases, over 5,000 blows were required to sink the pile to the bed rock. Sycamore piles alone were found capable of standing the continued batter of the pile hammer. The pile basis was used only when the pile was entirely protected from scour within the dike.

Piers No. 1 and 2 developed few novelties in their construction. Pier No. 2 was sunk six feet into the solid rock, making its base as stable as—and, indeed, a part of—the stratum in which it rests.

Pier No. 3.—This foundation is in 23 feet of water, at ordinary stage. The current is very swift, and the bottom is apparently solid rock. A wooden caisson, without floor, was sunk on the site, bolted to the rock, and a submarine wall, composed of large boxes filled with beton, built around it at a distance of six feet from the caisson, and the intervening space was puddled with concrete. The caisson was then pumped out; but, before the bed was laid bare, the rock bottom blew up, revealing the fact that the caisson rested on an imperfect ledge of limestone, below which was a decomposed seam. The bottom was then excavated by divers until solid rock was reached. The crater was filled with concrete and two courses of stonelaid upon it. The foundation was then ready for pumping out, but at this juncture the river rose twenty-six feet, and, although another section was added to the caisson, the water finally drove the drift-men from their work, and the drift accumulated to such an extent that the caisson was completely crushed and piled in a mass of wreck over the foundation. On the subsidence of the river the wreck was cleared away, and the foundation proving uninjured, the pier was built in a caisson boat and sunk on the spot.

Pier No. 4.—At this point the rock lay 54 feet below ordinary water stage and there was a varying depth of sand and boulders of from 11 feet to 53 feet. At the time of the flood of 1869 all the piles were driven for the breakwater, and these soon collected a mass of drift covering more than an acre, and drawing from 25 to 30 feet of water. This caused a deep hole to be scoured, and into it the boulders, moving with the sand wave, rolled, and, failing to mount the slope of the farther side, they remained in the excavation and were soon afterwards covered with the pile wreck—the whole of which having been crushed down flat on the boulder-bed by the pressure of the drift. When the drift was released the scour stopped, and the crater was filled with gravel by the action of the river.

It was through this tangled mass of drift and boulders that the foundation was afterwards carried. A double-walled caisson, with the interspaces between the walls filled with stone, was sunk by dredging to the solid rock. The work was tedious and difficult; four heavy water jets were kept running day and night, and all small boulders and gravel were fed to the dredges by

this means. Where the boulders were too large, or too tightly packed for this, they were moved with crow-bars by the divers, and if of more than half a ton in weight, were hoisted out by the derricks. When the rock was finally reached, it was cleared off and 12 feet of concrete laid, then two courses of stone, and then the pier was lowered to its place by means of screws.

Pier No. 5.—Here the rock was 68 feet from the surface, and the rise and fall of the sand wave, 32 feet. The compressed air system was used in the sinking, combined with the "Eads sand pump" and a peculiar boulder shaft, designed for this pier. One air lock was of the usual character, but placed at the foot of the shaft, and through this lock all the supply pipes, as well as the persons engaged in the caisson, passed. The other, or boulder lock, was also at the foot of the shaft, but was ten feet deep, and the air was so arranged that the changes were made too rapidly to be endured by the human frame, and, consequently, workmen were not permitted to pass through it. Two large doors opened into the chamber from this lock, and the iron boulder cars were pushed in through them, the doors closed, the air change made, the trap in the shaft dropped, and the cars were lifted out by the steam derrick overhead, and the boulders swung out over a barge, where the cars were tipped and emptied. This entire operation occupied less than three minutes.

The chief peculiarity noticeable in sinking this foundation and that of No. 4 was the great friction of the material. No. 4 never moved with less than 466 pounds per square foot of skin immersion, and at No. 5 it was frequently found necessary to let the air escape suddenly from all the blow-off cocks and sand pumps before the caisson began to move. In spite of this, however, through the vigorous management of Mr. Sherard, Principal Assistant Engineer, the caisson was sunk to rock in 49 working days—3 feet 4 inches being the greatest progress in any one day.

Piers 6, 7 and 8 are all alike in the character of their foundations. First a circle of "tub-piles" was driven, inside of these a caisson was sunk some 30 feet by dredging, and the circular crater outside of the tub-piles was filled with stone as the caisson sank. This process was kept up until stone from the crater began to appear in the dredge buckets—showing that the ring of riprap had begun to pass beneath the tub-piles. When this took place the dredges were removed, the piles were driven down to the rock, cut off at the level of the bottom of the caisson, and the pier was lowered on to the pile heads by means of screws. The caisson was then filled with stone and the work was complete. These piers are 151 feet from the base of the piles to the top of the masonry. From the base of pier No. 5 to the top of the truss is 186 feet.

#### Some Observations on the Reading of Drawings.

Even those who have been accustomed to working by drawings experience difficulty in understanding them. We propose giving a few directions whereby a properly executed drawing may be deciphered.

Many working drawings have shade lines applied on the following principles: As the drawing lies flat upon the board, light is supposed to come from the left hand upper corner at such an angle that the "projection" of a ray upon the plane of the paper makes an angle of 45 degrees with an horizontal line. Accordingly, it will shine over the right hand and lower edges of the object, when there is a contrast between the light and dark sides. These edges being thus made prominent are represented by heavier lines than the other edges. In the case of a cylinder, sphere, or other body having a rounded surface, the right or lower side has a line but little heavier than that on the light side. We can by the above rule distinguish between a hole in or an opening through a surface from a projection standing out from the same; for in the former case the left hand and upper edges are heavy and in the latter the right hand and lower edges so.

When locating the different views on the paper, the plan should lay below the longitudinal elevation, and the view of either end should be next to that end aside from the elevation.

Sections such as the spoke of a driving wheel, etc., are represented by imagining the section to be made and revolved on the cutting line so as to bring it in the plane of the paper.

Always notice on what line sections are made, for it is not always marked in the drawing.

When inclined flat surfaces are shaded in a drawing, on the light side the darkest part of the shade lies nearest the spectator, while in the shadow the reverse is true. When, however, several flat surfaces are represented parallel to the plane of the paper, the darker a surface is the greater its distance from the spectator.

In a section, each adjoining piece should be sectioned with lines inclined at a different angle from its neighbor. Dotted lines should be omitted when they do not add to the clearness of a drawing.

#### Chicago Engineering Works.

This month is made memorable in the engineering annals of Chicago by the completion of two works of the first importance. One of these, the tunnel under the main stream of the Chicago River at La Salle street, was opened formally on the 4th inst. In constructing this work the experience gained in the work on the Washington street tunnel was of great value, enabling the engineer and contractors to prosecute the work rapidly, safely, and almost without accident or delay. Hereafter, probably, river subways in this city will be deemed ordinary engineering works, having scarcely more elements of uncertainty than bridges. But however simple in regard to difficulty they may be considered, they can hardly be regarded as "ordinary" in regard to magnitude and cost. There are scarcely any structures in the West more "monumental" in character. It is no less than 1,890 feet in length, 1,344 feet of which is a covered way, and its cost was very nearly half a million of dollars.

The other important work, though executed by the city, is nearly all beyond its limits. This is the deepening of the Illinois & Michigan Canal, so as to do away with all ascents from the Chicago River westward, and form a channel through which the water of the river may run westward to the Illinois, the Mississippi, and the Gulf of Mexico, instead of flowing its natural course northeastward to Lake Michigan, the St. Lawrence and the Atlantic. This has been done principally as a sanitary measure, to create a current in the river, which is the outlet of the sewers of the city, and which heretofore has been rather a stagnant canal than a stream, not discharging any considerable volume of water except when spring freshets have flooded it, or it has been flushed by pumping water out of it into the canal, when its current is reversed temporarily as it will be permanently by this improvement.

The work consisted in making the old channel of the canal from eight to ten feet deeper for a distance of twenty-six miles, nearly one-half of which was through limestone rock. It was commenced in 1865, and has been prosecuted almost entirely during the season when navigation was closed. The cost is about \$3,725,000.

It is hoped that the canal will hereafter be enlarged so as to accommodate lake and river vessels, and in that event the work which has been done will be of great value as an improvement in transportation; but at present it affects but little the capacity of the canal and is useful chiefly as the great sewer of Chicago.

The removal of the locks at the lower end of the work will probably be accomplished next week, and after that time, it is hoped, the Chicago River will cease to be a nuisance.

#### The Michigan Central Report.

A summary of this document, which this year is unusually interesting—giving the result of the first year's experience with the numerous new branches, and of operating the main line with an unusually heavy freight traffic and passenger trains at exceptionally high speeds—will be found on another page. We commend it to the attention of all interested in the operation of railroads.

#### The Railroads of the United States.

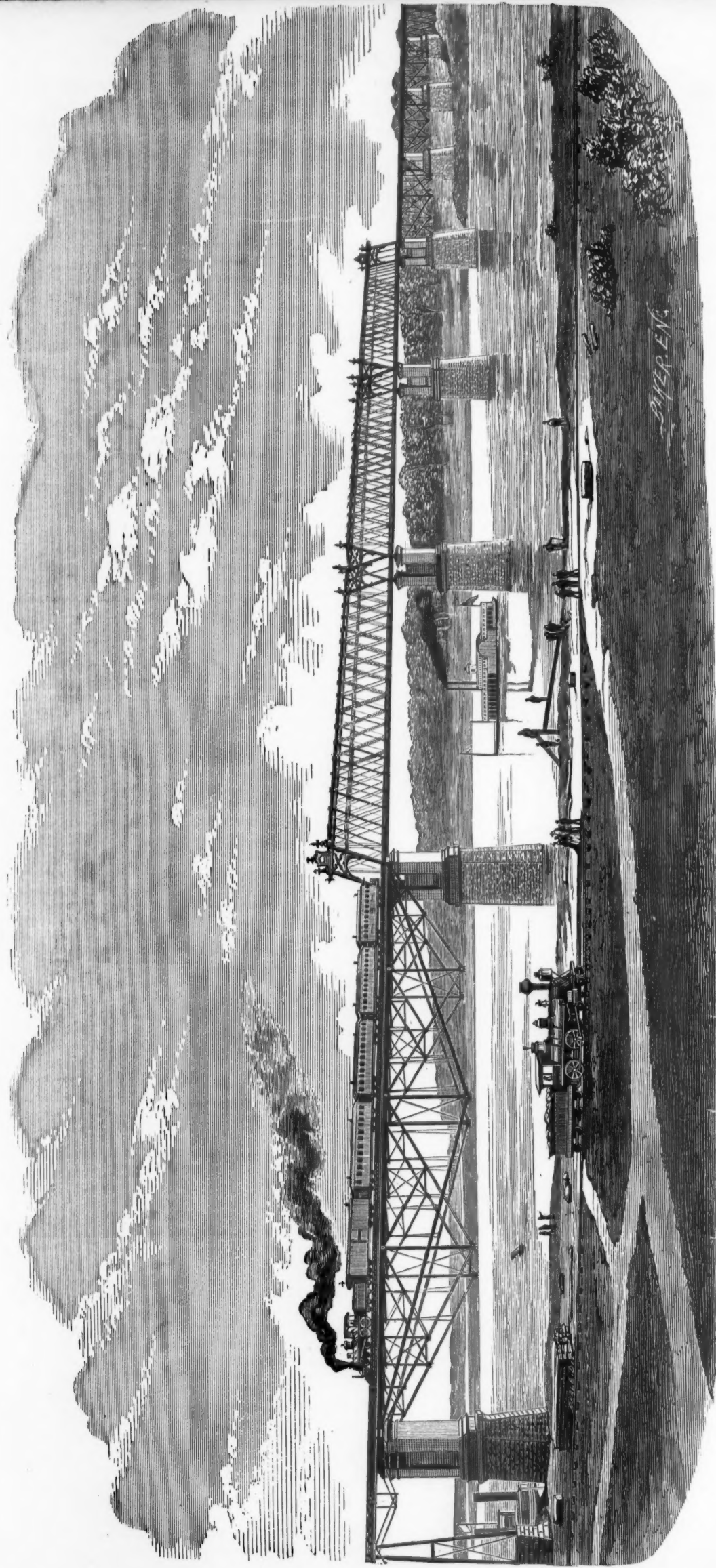
The progress of railroad construction in the United States, and the history of the operation of the railroads of the country, is given annually in the invaluable *Manual of the Railroads of the United States* of Mr. Henry V. Poor, the fourth series of which is just published. This work is compiled with great care, is unusually complete and remarkably accurate. By it we learn that the number of miles of railroad in the United States increased from 47,254 at the beginning of 1870 to 53,399 at the close of that year, an increase of 6,145 miles during the year. Of this increase no less than 4,004 miles, or nearly two-thirds, was in the Western States—Ohio, Michigan, Indiana, Illinois, Wisconsin, Minnesota, Iowa, Kansas, Nebraska and Missouri; and in Illinois alone there was an increase of 792 miles, one more than one-eighth of the entire increase of the country, while it has little more than one-sixteenth of the population of the nation. The States showing no increase are Vermont, Massachusetts, (this, we think, is an error), West Virginia and Florida. But in all those States considerable work on new lines was done in 1870 even if no track was laid.

The aggregate earnings of the roads of the United States is estimated by Mr. Poor at \$450,000,000, or about \$9,000 per mile, which indicates that an average of









RAILROAD BRIDGE OVER THE MISSOURI RIVER, AT ST. CHARLES, MO., 18 MILES FROM ST. LOUIS.

C. SHALER SMITH, Engineer.

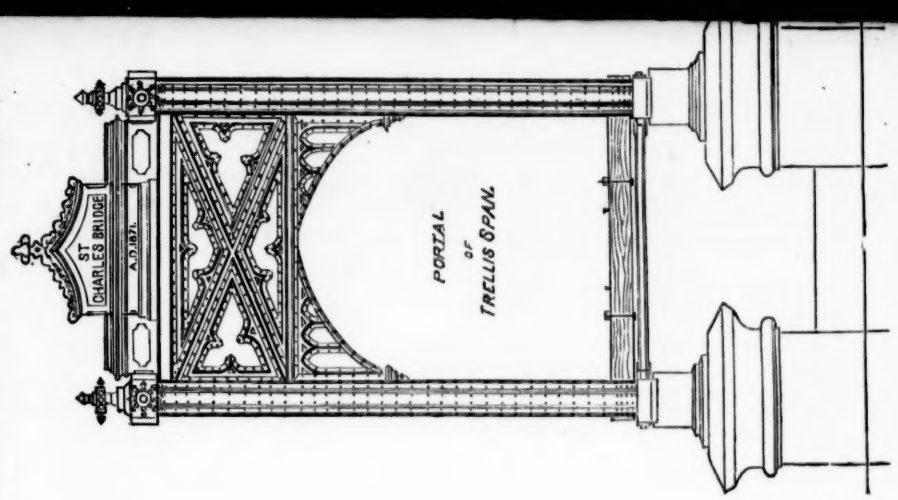
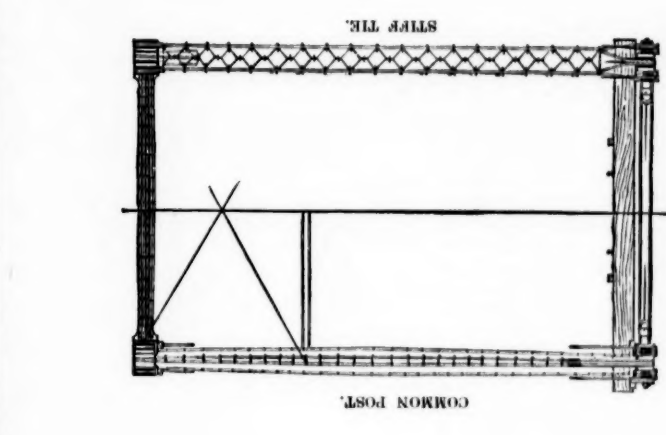
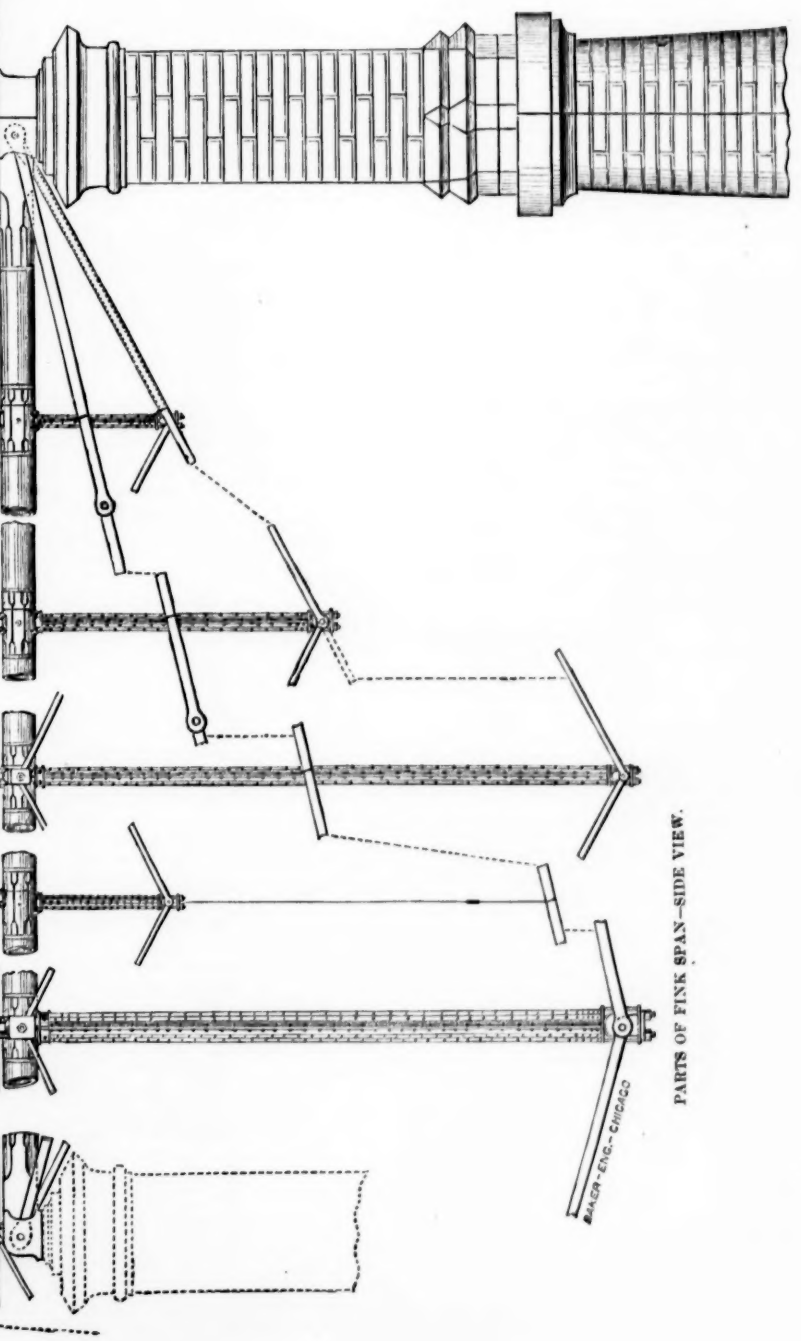
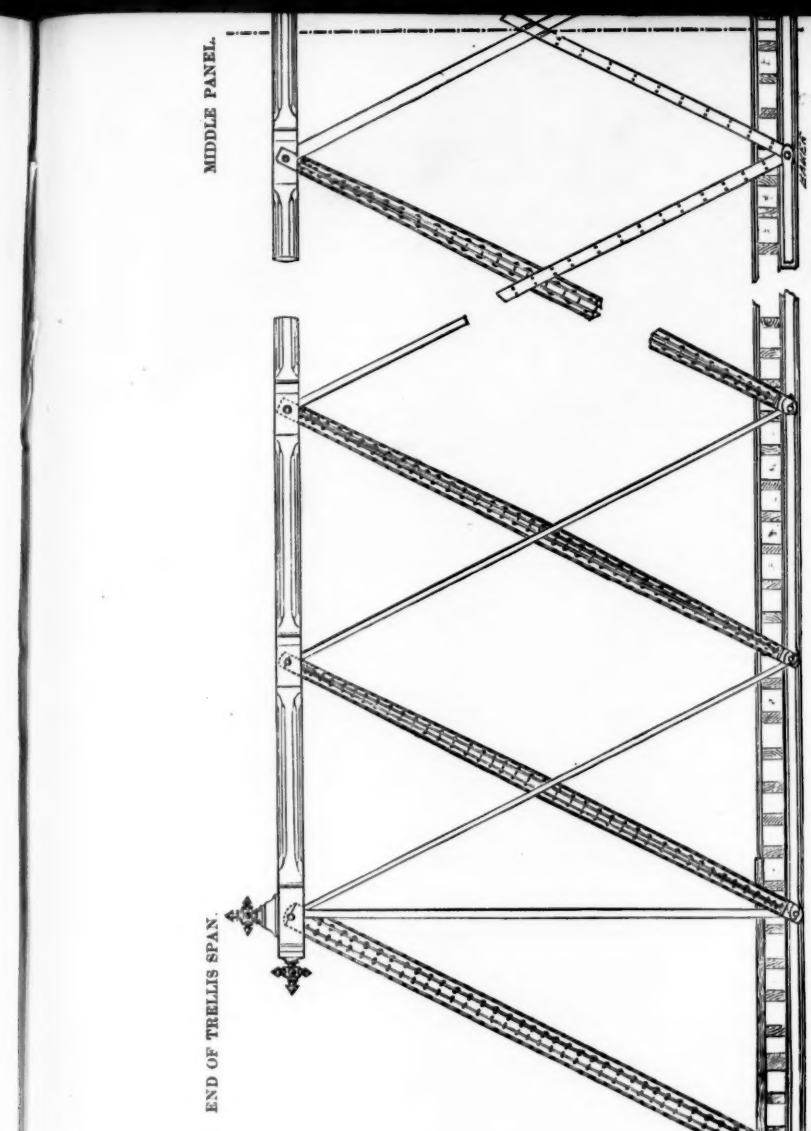
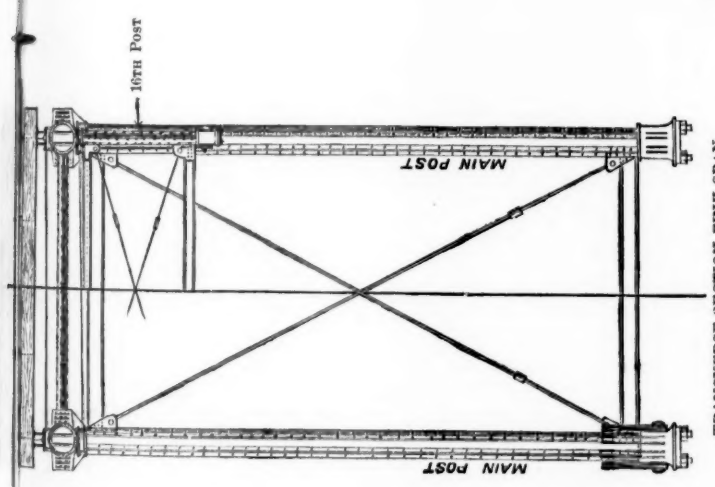
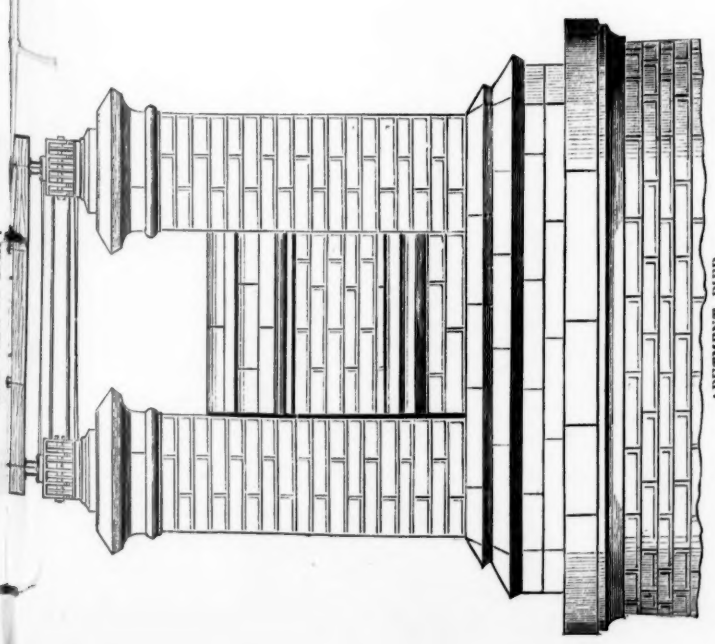
[For Description, see Page 169.]

END VIEW OF SPAN.





END VIEW OF SPAN.







about \$12 each is paid for transportation by each man, woman and child in the nation.

We hope to be able to present some of the important statistics of this work soon. Meanwhile we commend our readers to the work itself, which is an octavo volume of 592 pages, giving an account of the mileage, stocks, bonds, cost, traffic, earnings and expenses of the several railroads of the United States, with a list of the directors and officers of each.

### MICHIGAN CENTRAL RAILROAD.

Report for the Year Ending May 31, 1871.

The Michigan Central Railroad Company owns the main line from Detroit to Chicago, 284 miles long. It operates under leases the Joliet & Northern Indiana Railroad, from Lake Station (35 miles southeast of Chicago) west to Joliet, 44½ miles; the Grand River Valley Railroad, from Jackson (76 miles west of Detroit) west by north to Grand Rapids, 94 miles; the Michigan Air Line Railroad, from Kalamazoo (140 miles from Chicago) eastward to Jackson, 103 miles, and the Kalamazoo & South Haven road, from Kalamazoo west to South Haven, 36 miles. It has, since the close of the last fiscal year, commenced the operation of a line from Niles south to South Bend, 8 miles constructed, we believe, under the charter of the Michigan Air Line Company. It thus operates 500½ miles of line, its branches exceeding by 1½ miles its main line. All of these branches, with the exception of the Joliet & Northern Indiana, were operated last year for the first time. The Grand River Valley was operated during the whole of the year, the other lines for part of it only. The accounts of earnings and expenses of each, as will be seen, are presented separately.

### SUPERINTENDENT'S REPORT.

We give herewith a large part of the report of H. E. Sargent, the General Superintendent of this road, giving in detail the result of the operations of the year on the main line and the several branches. It is on these statistics that the report of the President is founded, and we therefore present them first:

#### COMPARATIVE STATEMENT OF EARNINGS AND EXPENSES OF ENTIRE LINE, INCLUDING BRANCHES.

	1870.	1871.	Increase or Decrease.
<b>Earnings.</b>			
Passenger.....	\$1,914,921 75	\$1,912,373 67	-\$2,548 08
Freight.....	2,634,438 87	3,329,639 70	+695,199 83
Miscellaneous.....	157,927 35	178,314 62	+20,387 27
<b>Totals.....</b>	<b>\$4,707,287 97</b>	<b>\$5,420,328 39</b>	<b>+713,040 42</b>
<b>Expenses.</b>			
Operating expenses.....	\$2,899,830 99	\$3,774,850 51	+\$875,019 52
Taxes.....	114,083 96	86,160 84	-\$27,923 12
<b>Totals.....</b>	<b>\$3,013,914 95</b>	<b>\$3,861,011 35</b>	<b>+\$847,096 40</b>
Ratio of expenses to earnings, including taxes.....	.64 3-100	.71 11-100	+6 88-100
Exclusive of taxes.....	.61 60-100	.69 93-100	+8 33-100

#### SEPARATE EARNINGS AND EXPENSES OF THE MAIN LINE AND BRANCHES.

	Gross Earnings.	Expenses.	Net Earnings.
Main Line.....	\$4,978,070 15	\$3,533,304 35	\$1,444,765 80
Joliet Division.....	109,723 35	15,776 09	93,947 26
Grand River Valley Div.....	251,633 83	136,510 07	115,123 76
South Haven Division.....	43,705 35	23,819 04	19,886 31
Michigan Air Line.....	25,831 17	.....	25,831 17
Niles Division.....	11,169 40	6,701 70	4,467 70
<b>Totals.....</b>	<b>\$5,394,202 22</b>	<b>\$3,861,011 35</b>	<b>\$1,533,190 87</b>

#### COMPARATIVE EARNINGS AND EXPENSES OF MAIN LINE.

	1870.	1871.	Increase or Decrease.
<b>Earnings.</b>			
Passengers.....	\$1,914,921 75	\$1,738,181 38	-\$176,740 37
Freight.....	2,634,438 87	3,072,557 58	+438,118 71
Miscellaneous.....	157,927 35	167,331 19	+9,403 84
<b>Totals.....</b>	<b>\$4,707,287 97</b>	<b>\$4,978,070 15</b>	<b>+\$270,782 18</b>
<b>Expenses.</b>			
Operating expenses.....	\$2,899,830 99	\$3,455,480 18	+\$555,649 19
Taxes.....	114,083 96	82,724 27	-\$31,359 69
<b>Totals.....</b>	<b>\$3,013,914 95</b>	<b>\$3,538,204 45</b>	<b>+\$524,289 50</b>
Ratio of expenses to earnings, including taxes.....	.64 3-100	.70 3-100	+6
Exclusive of taxes.....	.61 60-100	.69 41-100	+7 81-100
Passenger earnings per mile.....	\$6,742 68	\$6,130 35	-\$612 33
Freight earnings per mile.....	9,376 19	10,818 86	+1,442 67
Miscellaneous earnings per mile.....	556 08	599 19	+43 11
<b>Total earnings per mile.....</b>	<b>\$16,574 95</b>	<b>\$17,528 40</b>	<b>+\$953 46</b>

The freight earnings during the year, as compared with the previous year, are as follows:

	1870.	1871.	Increase.	Decrease.
Local East.....	\$774,391 07	\$776,993 19	\$2,602 12	..
Loc West.....	626,133 40	717,922 92	91,789 52	..
Through East.....	823,577 96	1,045,579 22	222,001 26	..
Through West.....	479,331 44	532,357 25	53,025 81	..
<b>Totals.....</b>	<b>\$2,634,438 87</b>	<b>\$3,072,557 58</b>	<b>\$438,118 71</b>	<b>..</b>

Percentage of local increase.....11.49  
 " of through increase.....21.95  
 " of through and local increase.....16.63  
 " of local to entire freight earnings.....48.64  
 " of local passenger and freight earnings to all earnings.....47.44

The increase of tonnage on all freight amounts to 31.21 per cent.

Passenger earnings, as compared with the previous year, are as follows:

	1870.	1871.	Increase.	Decrease.
Local East.....	\$482,045 03	\$486,417 43	..	\$4,372 40
Local West.....	459,161 00	430,717 09	..	28,443 91
Through East.....	456,989 01	409,807 90	..	47,181 11
Through West.....	481,778 94	427,607 43	..	54,171 51
Emigrants.....	64,932 77	33,631 53	..	31,301 24
<b>Totals.....</b>	<b>\$1,914,921 75</b>	<b>\$1,738,181 38</b>	<b>..</b>	<b>\$176,740 37</b>

Percentage of local decrease.....4.84  
 " of through decrease.....10.80  
 " of emigrant decrease.....48.22  
 " of local to entire earnings.....49.89

There has been a general falling off in our passenger traffic of the main line during the year, both in number of passengers carried and in receipts—our local travel having suffered alike with the through. Compared with the year previous, it will be seen by reference to Table D, that 28,387 less local passengers have been carried, showing a falling off of \$44,171.51, or nearly five per cent. on this class of earnings. The through passengers carried, including emigrants, have been 22,000 less in number, and the earnings of this class have fallen off \$132,067, or quite 13 per cent.

The ratio of earnings to number of passengers shows a falling off of the former, in consequence of the reduced rates of fare on through travel, as compared with the average rates of the year previous.

The falling off of through travel between Chicago and the East is not confined to our line, and is in part attributable to the improved condition of the southwest lines, that are diverting the lower Mississippi travel by their shorter distance to the seaboard.

#### PASSENGER TRAINS.

Three daily through express trains and one way mail have run during the year, with way accommodation trains between Detroit and Dexter and Chicago and Kalamazoo. Through drawing-room and sleeping cars have been run daily between Chicago and New York, and through sleeping and day cars to Suspension Bridge and Rochester on all express trains. By an arrangement with the Grand Rapids & Indiana road from Kalamazoo, close connections are made to accommodate the travel between Chicago and interior Michigan, and sleeping cars are run through to and from Grand Rapids.

Three trains, one passenger and two mixed, have been run daily on the Grand River Valley Division, with satisfactory results, as will be seen by the table of earnings.

#### FREIGHT EARNINGS.

The earnings of this department show a healthy increase, both in tonnage and receipts.

The increase in tons carried, local, has been 43,611 tons or 16½ per cent., with 11½ per cent. of increase in receipts.

The increase in tons carried through has been 187,943 tons or 56½ per cent., while the gain in receipts has been but 22 per cent.

The increase in tons moved, of all freight, over the previous year has been 34½ per cent., while with diminished passenger earnings the increased expenses of all kinds are 6 per cent.

The unusually large amount of freight passing over the line during the winter months, together with the inclemency of the season, demonstrated with us the fact that the volume of this class of traffic exceeded the point of economical working over single track.

The completion of the Air Line, by which two-fifths of our road will hereafter be used as a double track, with the aid of additional sidings east of Jackson, is our effectual remedy, and provides largely for future increase.

The Air Line Division between Niles and Jackson was partially opened for local traffic on the 1st of February last, but the necessary occupation of the road by construction trains and the unprepared facilities for doing business, have only recently admitted the passage of through freight trains in one direction over the road.

The ballasting, fencing, sidings and buildings are so far completed that we should enter upon all the advantages of the new line early in July.

The Kalamazoo & South Haven Division is being economically worked, and with fair results, in view of the fact of its location through a new and sparsely settled timber section.

Mills have been erected this season which are turning out the finer qualities of lumber, of which 1,200 carloads are now contracted for and moving to the Eastern markets, all paying good rates to this Company.

Under recent arrangements with the Chicago & Michigan Lake Shore road, lumber is coming forward freely from that line destined to points south and west of Chicago.

### PRESIDENT'S REPORT.

President Joy, after giving a summary of the receipts and expenditures of the year, showing that the gross earnings of the main line in 1870-71 exceeded those of the previous year by \$270,782.18, the gross earnings of all the lines by \$712,835.42, and that the gross expenses of all the lines have been greater by \$847,096.40, leaving the net earnings less by \$134,360.98, explains that the increase in expenses was the result of a combination of causes, including an increase of traffic beyond the capacity of the road and sidings; unusual speed of passenger trains, which, together with the increase in the number of trains, wore out the iron rails very rapidly, and compelled the renewal and repairing of 104 miles of the main line; and the very low rates of west-bound freight during the first half of the year, caused by the competition of the Eastern lines, during which time, Mr. Joy says, the business was done for about the cost.

Mr. Joy says that with its present heavy business the life of the iron rails on the main line cannot be more than three years, and that the experience of the company has demonstrated that steel rails will last at least ten times as long. Consequently the Board has determined to lay steel track on the line from Detroit to Jackson, 76 miles. The traffic of the several branches passes over this part of the line, which therefore is exposed to the maximum wear. This track is now progressing, and is to be completed during the present year. On this part of the road, also, ten miles of additional sidings will be constructed. With these improvements it is believed that the line will be able to accommodate its traffic, and with moderate expenditures for renewals of rails. The capacity will be further increased by the use of the Air Line between Niles and Jackson for through business. This line has cost considerably more than was anticipated, owing largely to the deficit of the municipal aid voted, but declared illegal by the Supreme Court.

—The management of the coal mines at Streator has passed into the hands of a new President and Board of Directors, but two of the former board remaining, namely, Colonel Plumb and D. Streator. The new board is constituted as follows: C. O. Godfrey, of Hannibal, Missouri, President; A. T. Hall and J. M. Walker, of Chicago; Colonel Ralph Plumb, of Streator, and Dr. W. S. Streator, of East Cleveland, Ohio. The parties who have bought the controlling interest represent a large amount of capital. They are proprietors of fifty-six coal mines in Illinois, Missouri, and other states, and have a total of employees numbering 4,000.

—A suit has been begun in the United States Court, at Springfield, Ill., against the McLean County Supervisors, to recover the amount of interest due upon the bonds of the Lafayette, Bloomington & Muncie Railroad, which was repudiated by the Board of Supervisors at their last meeting.

This line is about to be fully completed and utilized, very few trains having been run on it heretofore.

The mortgage debt of the Kalamazoo & South Haven road, the interest on which the Michigan Central assumes, is stated at \$18,000 per mile.

The Grand River Valley road is reported to be in good condition, developing a good business and promising to be valuable.

The Ypsilanti & Hillsdale line, of 60 miles, is spoken of as one promising to bring considerable traffic to the Michigan Central, although that company has no pecuniary interest in it. The Fort Wayne, Jackson & Saginaw and the Chicago & Michigan Lake Shore are also spoken of as lines which will contribute traffic to the Central.

The policy of the company concerning branch lines Mr. Joy states as follows:

"The stimulus which has been given to enterprises of all kinds by the success which has attended many, and by an abundant currency, will continue until some revulsion in the finances of the country shall take place.

"There are multitudes of projected roads in this State, and some of them are building, but the Board do not in any of these see anything which should tempt this company to any connection with them. So far as possible, it has controlled those most likely to injure it when built, and which might, if controlled by it, become tributary to it. The policy, even to this extent and from such motives, may be hazardous, and whether wise yet remains to be proved.

"It remains now to fully equip the roads for business and make perfect the main line, and be prepared to do all the business passing upon them with the utmost possible economy, and though other roads building and to be built will more or less affect its business, it is believed that its rapidly increasing volume, with diminished expenses, will enable the company to realize a larger net result than in the past."

There were added to the rolling stock during the year 19 new locomotives, making the stock 128; 53 Blue Line and 212 other freight cars, making the stock of freight cars 1,914. Operating expenses have been increased by the charges for the cost of 20 passenger and seven baggage cars constructed for other roads, for which about \$100,000 is due.

For lack of rolling stock the company has had to pay \$100,000 or more mileage for the use of cars of other companies used in the fast freight lines running over its road. The increase of tonnage during the year has been more than 34 per cent.

The improvements which shorten the distance between Chicago and Detroit by this line and those of the Great Western, which will shorten the distance from Detroit to Buffalo, are regarded as important, "securing the shortest possible line to Buffalo and connections with all the roads there," and giving "as short and direct a line between Chicago, Buffalo and the Bridge, and consequently between Chicago and the seaboard, as can possibly be made on either side of Lake Erie, and with greatly more advantages than can be acquired by any other lines of roads, while it will be entirely free from the heavier grades and sharper curves found on the roads further south and passing across the mountains."

The arrangement for working in harmony with the Great Western has worked admirably, and its continuance is recommended as likely to secure all the benefits of a consolidation, while avoiding the objections to it. The condition of the Great Western and its management are commended in the highest terms.

The connection with the Erie road by its branch to Suspension Bridge is considered important.

The following summary of the capital account is given by the President, who says: "Though this company is not directly liable for all these securities, yet they rest upon roads, worked by it, either under leases or working arrangements, which are equivalent to them."

The funded debt charged upon the Michigan Central road proper is now.....\$3,394,986 89  
 Less the amount in sinking funds.....1,474,383 28  
 Net bonded debt.....\$1,920,603 61

The capital stock now stands at.....\$14,665,848 00  
 The bonded debt is.....3,344,988 58

Bonded debt and stock together.....\$17,990,836 59  
 Or, less the amount in sinking funds.....1,474,383 28  
 \$16,516,453 31

The stock has been increased since last year by \$1,139,000, made necessary to meet the cost of the various works herein alluded to, and by \$301,000 by conversions of bonds, in all.....\$1,440,000 00

In addition to this, however, are the amounts of the bonds secured upon the tributary roads herein mentioned, viz., bonds, bearing 8 per cent., on the Grand River Valley Railroad.....1,500,000 00

Bonds secured on Air Line from Jackson to Niles.....1,900,000 00

Bonds on Kalamazoo & South Haven road.....710,000 00

Bonds on Joliet Branch.....800,000 00

Detailed reports are given by the Treasurer, Trustees of Sinking Funds, and Superintendents of Locomotive and Car Departments, which we must pass over for the present.



## General Railroad News.

## CHICAGO RAILROAD NEWS.

## Chicago, Rock Island &amp; Pacific.

The following account of the new work done on this road during the year ending with March last we take from the General Superintendent's report, being a part omitted last week:

New in-freight depot in Chicago, 600 feet by 60, of brick, and slated roof, with conveniently arranged offices.

New side-tracks to freight depot in Chicago.  
New water-tank, with brick foundations, in Chicago.  
Filling Clark street and adjacent depot grounds, about five feet; raising tracks and ballasting the same.  
New timber, cattle-guards and fences at street crossings, from Twenty-second to Thirty-first street, in Chicago.

New pump and pump-house at Lake, with protecting crib. Six-inch cast-iron pipe laid from Lake Michigan to new shops, 14,800 feet.

New coal shed, on stone foundations, 300x32 feet, with cranes and buckets for convenient coaling of engines, at Chicago shops.

New dry-houses, of brick, for drying lumber and sand, with exhaust steam.

Eight miles of new fence, both sides of Washington Heights track.

Second track, graded and laid from Englewood to Washington Heights, 5½ miles.

At Joliet, new side-track, 7,760 feet long, to gravel bank, to secure transportation of gravel to Chicago. A connection with the Illinois State Penitentiary and the Union Rolling Mills may be secured by laying a branch from this track about half a mile.

Between Joliet and Bureau a number of timber structures have been replaced with masonry.

Artesian wells have been put down at Morris and Ottawa, and an abundant supply of good water obtained at each place.

At Henry, a new track from station to Illinois River, 6,739 feet, has been laid, to secure the transportation of a large quantity of stone from Joliet, used in the improvement of river navigation.

Second track from Port Byron Junction to Moline, 4½ miles, has been laid and brought into use.

At Rock Island, two abutments and three piers of substantial masonry for new bridge over slough, with embankment to the Illinois shore, and trestle-work on pile foundations from bridge abutment to Island, have been constructed during the year.

In Iowa, important additions have been made to the side tracks at Davenport, Muscatine, Oxford, Homestead, Brooklyn, Grinnell, Des Moines, Van Meter, Stuart, Atlantic, Council Bluffs, and other points, amounting in the aggregate to nearly five miles.

Two arch culverts and abutments for seven bridges, to replace wooden structures, have been built by contract.

The work of reducing grade at Iowa City Bluffs has been prosecuted, except during the winter months, and is now nearly completed, and track ballasted with stone on the established grade of 40 feet to the mile, in place of the original grade, varying from 70 to 100 feet to the mile.

The summit cut, at Adair, has been reduced to the grade originally contemplated—40 feet to the mile.

At Kellogg and Earlham quarries, forces have been employed quarrying stone, which has been mostly used in ballasting track between Marengo and Newton and west of Des Moines, at points where it has been difficult or impossible to obtain gravel.

At Brooklyn, a new engine-house of nine stalls, built of brick, with small repair shop, all heated with steam, and a new coal-shed, have been erected.

New station buildings for the accommodation of passengers and freight, have been built at Walnut, Van Meter, Ainsworth, Grinnell Junction, West Liberty and Columbus Junction. The three last named being at points of intersection with other railroads, one half the cost has been paid by this company.

New permanent water tanks have been erected at Davenport, Fredonia, Tiffin, Oxford, Anita, Atlantic and Selsby, with wind-mills at all points except the first named, which is supplied by steam pump.

An addition to Stuart machine shop, and kitchen at Avoca eating house, have been added. Two million four hundred and seven thousand feet of fencing boards, 271,000 cedar fence posts, and 8,375 rods of wire fence have been purchased and used, equivalent to 275 miles of board and 25 miles of wire fence, mainly used for new fence in Iowa.

The condition of the road-bed has been materially improved by the widening of cuts and embankments, better drainage, and additional ballast, while the excellence of the track has been fully maintained, and will compare favorably with other leading railroads.

The leading items of expenditure for repairs and renewals of track, have been as follows:

	Cost.
110,079 ties.....	\$ 59,898 64
2,392 1630-2240 tons iron rails, re-rolled.....	95,104 08
3,011 2154-2340 tons steel rails.....	305,993 58
110 1574-2240 tons steel-capped rails.....	6,048 69
250,530 lbs. railroad spikes.....	11,305 88
263, 04 lbs. fish bars and bolts.....	10,325 81
16,061 joint-fastenings for steel rails.....	16,628 46
18,876 rails repaired in company's shops.....	13,865 24
Track laid with re-rolled rails.....	30 46-100 miles.
Track laid with steel rails.....	33 24-100 "
Track laid with steel-capped rails.....	1 13-100 "
Total laid this year.....	64 88-100 "

The following are the principal items of repairs and renewals made in company's shops:

	LOCOMOTIVE DEPARTMENT.
New boilers and fire boxes complete.....	11
New steel fire-boxes.....	11
New steel tires.....	9

New driving-wheels.....	12
New steel axles.....	9
New cylinders.....	8
New tenders, complete.....	8
New engine cabs.....	10
New pilots.....	12
New crank pins.....	37
New smoke-stacks.....	118
Number of engines repaired and generally overhauled.....	59
" " had tires turned once.....	65
" " painted or varnished.....	82
" " fitted with patent safety valve.....	38
" " " patent glass bearings.....	59
" " Westinghouse Air Brake.....	3
" pairs new truck and tender-wheels and axles.....	386

Average cost per mile run for repairs, oil, waste, fuel and wages of engineers, firemen and wipers, 23 01-100 cts.

Earnings per mile run by passenger trains.....	\$2 02
" " freight trains.....	1 77
Expenses " " all trains.....	95
Cords of wood consumed by locomotives.....	9,475
Average cost per cord delivered on engines.....	\$4 53
Tons of coal consumed by locomotives.....	75,403
Average cost per ton delivered on locomotives.....	\$2 98
Total cost of fuel used by locomotives.....	\$237,632 69

## Chicago &amp; Northwestern.

The contract has been let for the construction of the extension of this company's Fox River Valley line from Elgin north to Geneva (near the Wisconsin line), from Geneva to Geneva, Wis., about nine miles. There is an old grade, and it is intended to have this section completed this month. It is intended to extend it further to Elkhorn.

The contract for the construction of the "Menominee Extension," of the Wisconsin Division, from Fort Howard northward on the west side of Green Bay to Menominee; 55 miles has been let to George L. Dunlap, late the General Manager. Several lines have been surveyed for this extension, but the route is not yet finally determined.

## The Illinois &amp; Michigan Canal.

The work of removing the locks has been done slower than was expected, and it is not probable that the canal will be opened again and the water of Lake Michigan permitted to run up the Chicago River until the end of next week.

## Chicago &amp; Alton.

The company reports as follows its earnings for the month of June:

1871 (511 miles).....	\$466,582 19
1870 (466 " ).....	408,658 80

Increase (14 per cent.).....\$57,923 39

For the six months ending June 30 the earnings were:

1871.....	\$2,397,438 87
1870.....	2,10,426 46

Increase (14 per cent.).....\$292,012 41

In 1870 the length of road operated averaged about 450 miles; in 1871 it has been 511 miles. The increase in mileage has thus been about 13 per cent.—a little less than the increase in earnings.

## Illinois Central.

This company has recently turned out from its shops in Chicago and put on its Hyde Park train a new smoking car, which in elegance and comfort is superior to most first-class cars, and equals many "palace" cars. It is highly appreciated by the suburban residents, who coming into town in the morning are glad to have a pleasant place to smoke their after-breakfast cigars.

## OLD AND NEW ROADS.

## Jackson, Lansing &amp; Saginaw.

The track is laid for twenty-four miles on the extension of this road from Wenona northward, and it is to be completed to Standish, on Pine River, four miles further, by the end of next week.

## Pekin, Lincoln &amp; Decatur.

This railroad, hitherto in operation from Pekin, Ill., southwest to Delevan, 14 miles, on the 4th inst. was opened to Lincoln, 20 miles further. There remains 30 miles to be completed between Lincoln and Decatur. It will form a branch of the Toledo, Wabash & Western road.

## New York &amp; Oswego Midland.

On the first inst. a contract was let for the construction of the part of this line, in Delaware and Sullivan counties, New York, which will make the line complete from Oswego to Jersey City.

## Michigan Midland.

This company was organized a year ago to build a road from Chicago across the State of Michigan to the St. Clair River, at the city of St. Clair; to connect there with the St. Clair Branch of the proposed Canada Southern road. Mr. John E. Kitton, President of the company, has had negotiations for a consolidation with the Peninsular Company, which has a line completed from Lansing as far west as Casopolis. Between Lansing and the river the surveys have been made, the lines mostly located, the right of way secured, and the contracts will be let during the present month. Should the consolidation be effected, the two roads would form quite a direct route across the State, approximating very nearly to the conventional "air line." Should the negotiations be unsuccessful, the Midland Company intends to proceed at once with the work westward from Lansing.

Mr. Kitton has, in the face of a considerable opposition, secured such support as to receive from an eastern contracting firm a proposition to build and stock the road in a first-class manner, from Lansing to St. Clair, completing the first 15 miles west from St. Clair, by the spring of 1872, and the whole contract by the 1st of January, 1873.

## Beloit &amp; Janesville.

A survey of this road was made last week, with a view to building it in time to connect with the Rockford Central road. The route as surveyed is less than 15 miles long.

## New Jersey Railroads.

A large number of important railroad enterprises in New Jersey are to be prosecuted during the present season. One of the most important movements is the recent assumption of the control of the New Jersey West Line road by Judge Asa Packer, and other capitalists of Pennsylvania, who were lately elected directors, Judge Packer becoming President. It is understood that the work which had been stopped, owing to the failure of the original contractors, will be pushed forward to completion. The plan as developed by recent events, is said to be to secure by this means an outlet to New York, entirely independent of the New Jersey Central, so that the advantage gained by that road, in securing the control of the Lehigh Navigation, and so gaining a direct and connected route from the anthracite coal fields, may be paralleled. From Durham a road has already been surveyed to Bethlehem, a distance of ten miles, making the connection with the Lehigh Valley complete, while from Newark the line of the Newark & New York Railway will serve as the outlet. The Lehigh Valley road is already in possession of the works of the Morris Canal, so that ample shipping facilities are guaranteed with their extensive water front at Jersey City. It is estimated that the route from the Lehigh anthracite region lessens the distance to tidewater about six miles. Another important road is the Newark & Hudson, a branch of the Erie, which has already made its surveys from Newark to New York, and secured the appointment of commissioners to appraise lands needed for the line. It will connect with the Paterson & Newark road, and give the Erie another avenue to New York. The Midland Company has been for some months at work at this end of its line, and already has the road built as far as Bloomingdale, in Passaic County, and will have trains running to Smithville, three miles beyond, by July 1. The New York & Hackensack extension has been opened as far as Spring Valley, 30 miles from New York, and is under contract to be completed to Grassy Point, on the Hudson, two or three miles above Haverstraw, by May 1, 1872. The Northern Railroad of New Jersey also runs now to Spring Valley. The Montclair Railroad Company is at work upon their line from Wynockle to the Passaic River. The Delaware, Lackawanna & Western Company is laying another track on its broad-gauge line via Paterson and Boonton. The New Jersey Central is building a spur road from Newark to Elizabeth, across the meadows, to accommodate some of its freight traffic, and as a precaution against delay in case of accident to the bridge across Newark Bay. Surveys have been made through Berkshire Valley, and the region about Lake Hopatcong for the proposed road to cross the suspension bridge over the Hudson. Local branches of the Midland and Montclair roads are also proposed. In the lower end of the State capitalists are no less active in building roads. Last winter a charter was granted for the construction of a railroad from Salem to Brighton, which its projectors contemplate building. It is proposed to connect by steamer between Salem and New Castle with the great through route from the latter place to Pittsburgh and the West. Commissioners have been appointed to solicit subscription to the stock of the May's Landing road from Atlantic County, to connect with the New Jersey road at Vineland. The Vineland Railway from Vineland to Atsion, the grading of which was done several months ago, but which has been at a stand-still with no immediate prospect of completion, is to be pushed forward. The Tuckerton Railroad is nearly finished, and cars, it is expected, will run over it at an early date.—Exchange.

## Erie Railway.

This company, it is said, is making surveys for a new line from Avon (on its Rochester branch about sixty-six miles east of Buffalo, and connected with the line to the latter place by what is known as the "Attica Branch") nearly due east to Canandaigua, about thirty miles, on a route very near to the Canandaigua and Batavia line of the New York Central. Intersecting the Northern Central at Canandaigua it would be able to carry coal from it to Buffalo and its western branches, and for this purpose it is designed to make it of 4-feet 8½-inch gauge.

## Gilman, Clinton &amp; Springfield.

The track on this road between Gilman and Clinton was to have been completed on Tuesday of this week.

## Delaware &amp; Hudson.

This company is about to lay down a third rail on the Albany & Susquehanna road and its connections to Scranton. The iron is already purchased, and the work will be commenced at once. This improvement will make transit connections with the Midland at Sidney, with the Rensselaer, the Central and Hudson at Albany, and from these several roads with all the narrow-gauge connecting roads throughout Pennsylvania and adjoining States, so that coal can be moved to any point desired without breaking bulk.

## Terre Haute &amp; Indianapolis.

This company, which owns the old road between the two places named, now forming the eastern end of the "Vandalia road," has declared a 6 per cent. dividend for the last half year.

## West Wisconsin.

A preliminary injunction has been issued by the judge of one of the Minnesota District Courts to restrain the West Wisconsin Railroad Company from building its bridge across Lake St. Croix, at Hudson, in accordance with its present plans. The injunction was applied for by several citizens of Stillwater, who last year endeavored to defeat legislation in favor of this railroad, in order to compel the crossing of the St. Croix at Stillwater, six miles above Hudson, and the action taken is in pursuance of a special law, which the company engineered through the Legislature, forbidding the bridge to be built to the Minnesota side of



the lake at any point below Stillwater. The law is not regarded by the friends of the road as worth anything. Among the latter are included the entire population of St. Paul. If the injunction proceedings are persisted in, the matter will be taken to the Circuit Court of the United States.

#### Boston & Lowell and Concord Railroads.

The contest between these companies has been transferred to the New Hampshire Legislature. The Boston *Advertiser* says: "The Concord road is pressing a charter for the extension of the road, chartered by the Massachusetts Legislature, from Dunstable to Nashua, while the Lowell line is petitioning for a charter between Concord and Nashua. The former charter, if granted, would give the Concord road a new line to Boston by way of Acton and the Fitchburg Railroad; the latter would enable the Lowell line to cut clear of all connection with the Concord Railroad. Neither road is needed, and there is no probability that either would be built if chartered. Each party to this contest is extremely anxious to secure a charter, but only to give it an opportunity to make better terms with the other in the settlement which it is practically certain will be eventually made.

#### Hamilton & Loveland.

A route for this projected Ohio road—from Hamilton, in Butler County, southeast to Loveland, in Hamilton County—has been surveyed and, as given in the Cincinnati *Gazette*, "follows the Miami Canal along or near the west bank, and crosses it just above Port Union, and from thence to a point about a mile above Sharon, in Hamilton County, where it will connect as a feeder for Hamilton with the Short Line road, at the same time constituting an independent route for the Cincinnati & Indianapolis Junction road to Cincinnati and the Eastern towns and cities."

#### Hamilton & Greenville.

This is, as yet, a "paper road," projected to run from Hamilton, Ohio, north to Greenville, and form a part of a north and south route connecting Cincinnati with Northern Michigan.

#### Sabula, Ackley & Dakota.

An Iowa paper reports that a statement has been made "on authority" that this road will be completed to Marion, Iowa, by the end of this year, and, if sufficient aid is furnished, through Vinton and to Buckingham next year.

#### Lawrence & Pleasant Hill.

It was expected to commence laying iron from Pleasant Hill westward this week, and to have the heavy grading about Blue River finished to-day. There are but 12 miles more grading to do, and this, with the culverts and bridges, will probably be completed by the 15th inst.

#### Stockton & Visalia.

Work has been commenced on this road, which will be about 200 miles long, and run from Stockton, California, southwest through the center of Stanislaus, Merced and Fresno counties, to Visalia, in Tulare County.

#### Sonoma Valley.

The construction of this connection of the California Pacific road has been begun. It starts from Adelante, the junction of the Sacramento and Napa Valley lines, and extends to the town of Sonoma. From that point the line is not definitely located, but will either go to Petaluma or to Donahue. A large force of Chinamen are grading from Adelante across the tule land, and work has been commenced on the drawbridge across Napa Creek.

#### The Costa Rica Railroad.

A correspondent of the New York *Herald* gives the following leading features of the contract recently made by the government of Costa Rica with Henry Meigs for the construction of a railroad in that country:

"The maximum gradient shall not exceed 4 per cent.; the minimum radius of the curves shall be eighty English feet; the bridges and viaducts shall be of iron and stone work; the track to be three feet six inches wide; T rails to be used with fish plates and suspended joints; rails to weigh forty-two pounds to the yard; sleepers six feet long, eight inches wide, and six inches thick; stations, warehouses, and all other edifices to be commodious, and especially those at San Jose and Cartago; seven of the best American engines to be placed on the line; five of the more modern first-class passenger cars and five second-class; twenty platform, thirty box, and three baggage cars; ten for cattle, to be supplied by the contractor; and in front of the depot at Limon there is to be a screw pile mole six hundred feet long by thirty wide." The road is to be constructed within three years, and hopes are entertained that on its completion the traffic will guarantee its extension to the Pacific.

#### Bridgeton & Port Norris.

The grading of this road is nearly completed from Bridgeton, the present southern terminus of the West Jersey Railroad, southeastward to Fairton, and track-laying is commenced. The road will be about 18 miles long, and will connect the West Jersey with Delaware Bay near the mouth of Maurice River.

#### Mississippi Central.

The Memphis *Advertiser*, of June 28, says: "The Mississippi Central Railroad Company have recently determined to make a contract with McComb to extend that road from Jackson, Tenn., to the Ohio River. McComb agrees also to pay the entire indebtedness of the company to the State of Tennessee with bonds of the State. For this indebtedness he will receive first mortgage bonds of the company, and, after the extension of the road to the Ohio River, \$1,000,000 in consolidated stock. We have been for the last year inclined to believe that McComb, as the agent of the lessees of the Mississippi Central, was not going to extend the road, and, but for the overwhelming advan-

tage now held by the Mobile & Ohio Railroad, we think he would be satisfied with the Central as it is. But a northern terminus at some railroad center is an absolute necessity. Paducah, we take for granted, will be the northern end, where a connection with a through line is to be made."

#### Southern Central.

The officers and directors of the Southern Central Railroad, now running from Athens, Pa., to Weedsport, N. Y., ninety-five miles, visited Oswego and Fair Haven last week to decide which place is to be the terminus of their road, which will be completed this year.

#### Rome, Watertown & Ogdensburg.

This company makes a division of 4 per cent. for the last half-year, payable on the 15th inst.

#### Toledo, Peoria & Warsaw.

The Vice-President of the Company, Col. W. H. Cruger, informs the Burlington *Hawkeye* that arrangements for the Burlington extension of this road were nearly completed. Two lines have been surveyed. There is a probability that the last one—from La Harpe—will be adopted. This route leaves the present line at La Harpe and runs northwest, 10 miles, to a junction with the Quincy line of the Chicago, Burlington & Quincy, near Honey Creek, 8 miles from the Burlington Bridge. By what is known as the "Terre Haute line," the divergence would be at Clarksville, 11 miles east of La Harpe, and, while the number of miles to be built would be increased, the distance between Burlington and Peoria would be shortened 3 or 4 miles. It was expected to have the choice of routes decided this week.

#### Houghton & Ontonagon.

It is reported that work will be commenced immediately upon this railroad, extending from the western terminus of the Bay de Nocquet & Marquette Railroad, east of Lake Michigan, west to the head of L'Anse Bay. The bonds of the road, to the extent of \$1,200,000, have been sold to M. Astor, Moses Taylor, John Stuart, and the Farmers' Trust and Loan Company, of New York.

#### Memphis & Kansas City.

The directors of this company, which is, we believe, to build the road through Arkansas to connect with the Kansas City & Memphis road in Missouri, met at Jacksonport, Arkansas, on the 23d of June. It was resolved to adopt the three-foot gauge and commence work at Jacksonport, Ark., and work each way from that point, provided sufficient means can be raised to construct a bridge over Black River, towards Batesville. A call of 5 per cent. on the original stock subscription was made, payable within 60 days.

#### Central Valley.

This is the name of the narrow-gauge railroad that is now under construction in Chenango County, N. Y. The plan is to make this road form the first link in a through line extending via Courtland and Auburn to the lakes. The rail to be used is limited by law to a minimum weight of forty pounds to the yard, while the gauge is three feet.

#### Central of New Jersey.

A branch railroad, about four miles in length, to connect the Central Railroad of New Jersey with the Newark & New York Railroad, has just been commenced, to be completed in about five months. The road commences at Elizabeth, and runs in a straight line across the Salt Meadows. The track, when completed, will be the means, it is believed, of restoring all the meadow lands lying west of it, as it will be laid upon an embankment high enough to shut out the overflows from the river.

#### Davenport & St. Paul.

The Davenport (Iowa) *Gazette* of the 30th ult. says: "We learn that President Price has received a dispatch stating that 5,000 tons of railroad iron have been purchased for the Davenport & St. Paul Railroad, and that the shipping of it will commence immediately. This will lay about fifty miles of road, if not more, and it can easily be seen where it will carry the road to; from the point to which the track has reached, which, we believe, is in the neighborhood of Allen's Grove, in this county, at least to Wyoming, in Jones County, if not to Monticello."

#### Anderson, Noblesville, Lebanon & St. Louis.

This new Indiana company held a meeting for organization in Indianapolis on the 29th ult. The following directors were elected: Boone County, O. S. Hamilton, T. M. Kersey, A. C. Daily, Levi Lane; Hamilton County, E. Cottingham, T. Teter, H. G. Kenyon, J. M. Smith; Madison County, Wm. Crim, W. R. Pierce; Montgomery County, D. C. Stover, W. B. Anderson, T. A. Messick. The road is to run from Anderson, Ind., a little south of west, to Paris, Ill., and be 103 miles long. The capital stock is \$2,000,000, in shares of \$50 each. After the meeting of stockholders, the directors met and elected the following officers: Wm. Crinnan, of Anderson, President; Elijah Cottingham, of Noblesville, Secretary; N. F. Dunn, of Noblesville, Treasurer.

#### St. Paul, Stillwater & Taylors' Falls.

A contract has been entered into by this company (of Minnesota) with several prominent citizens of St. Paul and Stillwater for furnishing and laying the iron on the road from St. Paul to Stillwater and Hudson, for ballasting the track, and for a full equipment of rolling stock, freight, passenger, baggage and other cars, at an aggregate cost of a fraction less than \$294,000—the whole to be completed by the first day of December next. A contract was also awarded to Clark & Co. for the grading of the remaining portion of the road.

#### Cairo & Vincennes.

General Burnside, President of this company, is trying hard to get the means to complete this road. Cairo has voted to restore a subscription of \$100,000 which had been forfeited by the company, and Cincinnati is called upon to make up some other forfeited subscrip-

tions. The following account is given of the condition of the road: "The entire length of the line as surveyed and located is 156 miles, and the greater part of the grading and earthwork has already been done. From Vincennes going south eighty-five miles of grading has been completed; while, starting from Cairo and going north a distance of thirty-eight miles, a greater part of the work is done. The intervening gap of thirty-eight miles, including some very heavy work in Johnson County, and a tunnel of 1,000 feet, remains to be done. Besides this, the greater part of the masonry and all the bridges are to be completed to make the road ready for the iron."

#### Burlington, Cedar Rapids & Minnesota.

The Blue Earth City *Post* has information from President Green that "the cars will be running to Mason City early in September, and that the company had, previous to Judge Hall's decision, made all arrangements to commence work north of Mason City in August. It is not probable that the road will be extended north of Forest City until after the Supreme Court has rendered its decision upon the bond question. Should that decision be adverse it is likely the company will do nothing in this State until after the next session of the Legislature, when an effort will be made to frame a law providing for voting aid to railroads in this State, which will obviate the legal objection to the present law."

#### South Indiana & Plymouth.

Articles of association on the South Indiana & Plymouth Railroad Company were filed with the Secretary of State of Indiana on the 1st inst. The road is to commence at South Bend and run to Plymouth, a distance of 24 miles. The amount of capital stock is fixed at \$250,000. The Board of Directors are Wm. G. George, Clement Studebaker, Wm. Miller, of Portage; Schuyler Colfax, Thos. Stanfield, Alexis Ocquillard, Chas. H. Reeve, Albertus Capron and George Willum. The road will connect at South Bend with the Lake Shore & Michigan Southern, and with the Michigan Central through its new Niles & South Bend Branch. At Plymouth it will connect with the Fort Wayne road, and also with the Chicago, Cincinnati & Louisville, which latter will give it a connection with Indianapolis, Louisville, etc.

#### New York & Lake Mahopac.

The last rail was laid on this line on the 4th inst.

#### Denver & Rio Grande.

The Colorado *Tribune*, of June 14, says of the construction of this narrow-gauge road: "Work is so far along that if the track-layers should begin to lay down rails to-morrow at the rate of three miles a day, the bridge-men and tie-fitters could keep out of their way, and 25 days would see the line in operation to Pike's Peak. The first installment of iron, enough to lay 30 miles, left Liverpool on the 12th of April, and the balance two weeks later. Good ties have been obtained at an average of six miles from the line, and a surplus of 60,000 have been got out. Sidings have been graded at Littleton, Plum, New Memphis, North Pine, Lake and other points."

#### Peoria & Rock Island.

The track-layers have reached Galva, going east, and Lafayette, going west, leaving a gap of but seven or eight miles between these points. It was expected to have this completed during the present week.

#### Chicago & South-western.

Atchison is discussing the advisability of voting aid to a branch connecting with this company's Leavenworth line. Such a line would not need to be more than thirty miles long.

#### Cincinnati & Terre Haute.

A company with this title was organized in Indiana on the 27th of June. It is proposed to build a narrow-gauge road from Terre Haute east, through the counties of Vigo, Clay, Owen, Monroe, Brown, Bartholomew, Decatur, Ripley and Dearborn, to Cincinnati. The length will be about 280 miles, and the capital stock is placed at \$4,000,000.

#### Portland & Rochester.

This railroad was opened through to Rochester, N. H., 52½ miles, on the 5th inst.

#### San Jose to Santa Cruz.

The survey of a route between these California cities, the commencement of which was announced some weeks since in these columns, has been completed. Col. Wm. J. Lewis has had charge of the survey, and he has, it is said, secured an available route.

#### A Proposed Relief of the New York Central.

A telegram from New York gives the following rumor:

"Details are mentioned here of a new railway enterprise which is to give an opposition line between here and Buffalo to the New York Central & Hudson River road. The new road is to follow up the west bank of the Hudson to Catskill, keeping close to the water's edge for the most part. From there it is to proceed in an almost direct line to the Mohawk at Schenectady; thence along the Erie Canal to Utica, and from there to Syracuse in a nearly westerly course, and in an almost straight line to Buffalo. It is claimed that this route will have no steep grades to encounter, no tunnels to bore, and few bad curves. The docking privileges that will be obtained along the lower twenty miles of the road are spoken of as likely to be extremely valuable, and it is believed that a very large meal business will be developed. The engineer of the company, General Stewart, proposes to build the track four feet eight and a half inches gauge, with cuts and embankments 24 feet wide at grade; bridges to be of wrought-iron; rails of steel, weighing 60 pounds per yard; with ties of white oak, and ballast of broken stone. The total cost of the 420 miles he estimates at \$26,213,500, or a little over \$62,000 a mile.



## Grand Rapids &amp; Indiana

A contract has been let to E. B. Talcott & Co. for grading 40 miles of this line, commencing at a point 20 miles north of Paris, the present terminus, and extending to the Manistee River and within 20 miles of Grand Traverse Bay.

## Elizabethtown &amp; Paducah.

The Board of Directors have under consideration a proposition from L. Y. Meyer, of New York, who represents foreign firms, and offers to furnish all the iron needed to complete the unfinished portion of the road from Greenville to Paducah, ninety-two miles, taking the bonds of the company at 87½. The interest on the payment, \$850,000, will make the above portion ready for iron. All of it under contract to be finished by April, 1872. The entire road is 195 miles long.

## Cincinnati, Wabash &amp; Michigan.

Articles of consolidation and agreement between the Warsaw, Goshen & White Pigeon Railroad Company and the Grand Rapids, Wabash & Cincinnati Railroad Company was filed with the Secretary of State of Indiana, on the 30th ult. The name of the consolidated companies is the Cincinnati, Wabash & Michigan Railroad Company. The capital stock of this new company is placed at \$2,250,000, divided into shares of \$100 each.

## MECHANICS AND ENGINEERING.

## Steam on City Railroads.

Citizens of New Jersey having requested the opinion of Samuel McElroy, a Brooklyn engineer, as to a new railroad which proposed to use the tracks of certain horse railroads, especially whether steam could be used on the city streets and locomotives run on the city roads, Mr. McElroy answered:

"Passenger or platform cars provided with simple and powerful engines could be advantageously used on a line of this kind, capable of carrying extra cars and of moving over 200 passengers on each train.

"The present horse-railway tracks could be used for the auxiliary locomotives.

"These locomotives can be run without smoke or sparks, and with less danger to horses than full sized engines.

"As between the slow and expensive operation of long passenger roads by horse power or steam, the difference is strongly in favor of the latter in cost of operating, and by the use of light auxiliary locomotives, the expenses for maintenance of track would be comparatively small. There is probably a difference of not less than twenty per cent. of gross receipts in favor of a plan of this kind in annual working outlay. Between a horse car and steam movement of five and one-half miles, the relative time would be as forty-five minutes to twenty minutes from Montclair to the city depot.

"This system is applicable to any horse railroad connecting with Newark having a proper depth of rail.

"It is equally applicable to nearly all the horse railroads in New York City and Brooklyn, and the introduction of steam power will soon supersede and drive away the prejudices of our people. It is only a question of time."

## Remarkable Locomotive Performance.

An express passenger locomotive, No. 422, built by the Baldwin Locomotive Works in 1867, has been in service on the Pennsylvania Railroad since that time, running 153,280 miles without being off her wheels for repairs. The performance is, we are informed, without precedent, and is the more remarkable in view of the severe character of the service. Her dimensions are: cylinders, 17 inches by 24 inches; drivers, 67 inches; weight, in working order, 71,000 pounds. The following is an extract from a letter of Mr. A. J. Cassatt, General Superintendent of the Pennsylvania Railroad Company:

"She was placed on the road on the 17th day of October, 1867, and run until the 14th day of May, 1871. During the whole of this time she hauled fast and heavy passenger trains over the Middle Division, and made the wonderful run of 153,280 miles, losing only three trips, which was during November, 1869, to have six new flues put in and to clean the mud out of the waist of the boiler. She also lost six round trips in May, 1870, getting a larger tank to enable her to make the run from Altoona to Harrisburg (132 miles) without a stop.

"This, however, was no fault of the engine and should not be counted against her. As an offset against the nine trips lost, she made eleven and one half extra trips between Altoona and Harrisburg.

"The total cost for repairs up to the time she was laid off amounted to \$3,727.06, or 2.44 cents per mile. Our book account makes these amounts somewhat greater, but I have deducted all items not actually running repairs, such as the new tender, cost of applying air breaks, etc., which, although under our system of accounts are necessarily charged to repairs, actually do not belong there.

"When engine 422 was taken into the shop she was reported as run down in the working parts, but uniformly so, all the bearing surfaces being smooth and good, and her general condition being better than is usual with engines taken in for repairs. The cost of placing her in thorough repair is estimated at \$1,262.73."

## TRAFFIC AND EARNINGS.

The following is a statement of the shipments of through freights eastward over the Central Pacific Railroad for each quarter of the year ending May 1, 1871:

From May 1 to Aug. 1, 1870.....	Pounds.
" Aug. 1 to Nov. 1, 1870.....	9,738,417
" Nov. 1 to Feb. 1, 1871.....	9,452,657
" Feb. 1 to May 1, 1871.....	7,290,333
Total.....	9,163,565

Total.....35,575,072

## LOCOMOTIVE STATISTICS.

From the reports of the master mechanics of the roads enumerated below the figures have been taken and tabulated for the sake of easy comparison.

## FOR THE MONTH OF MARCH, 1871.

NAME OF ROAD.	No. of Locomotives in service.	MILEAGE.				COST PER MILE IN CENTS.				NUMBER OF MILES RUN TO	AVERAGE COST OF		
		Passenger.	Freight.	Mixed.	Total.	Passenger.	Freight.	Mixed.	Total.		Coal, per ton.	Wood, per cord.	Oil, per gallon.
Illinois Central.....	1,109	168	115,240	247,030	362,270	9.34	6.36	6.66	7.44	5.95	13.64	25.92	50c.
Allegheny Val.....	132	40	32,714	51,224	83,938	6.15	5.11	0.81	12.07	7.93	27.25	35.83	2.70*
Chic. R. I. & Pac. (Ill. Div.).....	70		41,757	84,174	125,931	7.56	5.56	0.58	13.70	7.13	18.94	40.20	\$1.62
Chic. R. I. & Pac. (Iowa Div.).....	70		43,403	89,980	133,383	6.61	5.98	0.57	13.16	7.45	17.52	44.11	2.50

\* In Illinois. † In Iowa.

## FOR THE MONTH OF APRIL, 1871.

Chicago, R. I. & Pac. (Ill. Div.).....	66		39,760	90,713	130,473	7.22	6.43	0.57	14.22	7.17	19.89	49.26	2.75
Chicago, R. I. & Pac. (Iowa Div.).....	75		41,706	95,277	136,983	4.60	7.14	0.61	12.35	7.35	17.57	42.29	\$5.00
Han. & St. Jo.....	231	74	44,658	98,118	142,776	10.10	6.50	0.90	17.50	7.50	16.40	48.50	2.75
Pitts. Ft. Wayne & Chi. (E. Div.).....	319	138	73,553	227,356	300,909	8.91	5.68	1.15	15.74	7.00	13.68	44.16	2.51
Bur. & Mo. Riv. & Allegheny Val.....	450	138	39,127	70,419	109,546	6.53	9.00	0.82	16.40	8.13	14.07	38.26	3.50
Pitts. Cin. & St. L. (Lit. M. Div.).....	313	39	51,867	37,691	89,558	4.80	9.30	1.00	15.10	8.20	13.80	40	2.60
Central Pacific.....	1,020	118	1,020	118	1,138	29.42	13.63	15.70	29.42	6.68	14.35	27.42	8.72
Kansas Pacific.....	669		73,425	88,495	161,920	10.09	11.44	0.75	22.28	5.24	14.87	43.30	4.75

## FOR THE MONTH OF MAY.

Kansas Pacific.....	669		73,930	86,100	160,030	6.00	11.03	0.70	15.00	5.45	15.23	45.02	\$4.75
Toledo, Peoria & Warsaw.....	237	30	28,005	35,962	63,967	5.36	6.06	1.05	12.47	7.10	19.90	46.25	2.50
Mich. Central.....	500	15	84,612	132,915	217,527	5.36	6.06	1.05	12.47	7.10	19.90	46.25	2.50
Hannibal & St. Joseph.....	221	70	43,965	110,133	154,098	9.00	7.20	0.90	17.10	7.70	19.30	44.30	3.00

## ELECTIONS AND APPOINTMENTS.

—Charles R. Peddle, who recently resigned the superintendency of the St. Louis, Vandalia, Terre Haute & Indianapolis Railroad, was almost immediately appointed Superintendent of Machinery of the same road. There were formerly two division superintendents of the road, but this office is now abolished, and Mr. John E. Simpson, late the Superintendent of the entire division, will now, as General Superintendent, have the work which formerly devolved on the General Superintendent and two division superintendents.

—Governor Palmer has appointed as Railroad and Warehouse Commissioners of Illinois, Hon. Gustavus Körner, of Belleville; Col. Richard P. Morgan, Jr., of Bloomington, and David S. Hammond, of Hanover, Cook County. Mr. Körner is a German, many years a resident of this State, a good lawyer, and widely known among politicians, having held many offices in the State and been at one time Lieutenant-Governor. He is nearly seventy years of age. Colonel Morgan is a civil engineer of many years' experience, and a man of character and ability. He was some years ago Superintendent of the Chicago & Alton Railroad. Mr. Hammond is a farmer residing in the northwest corner of Cook County, near the city of Elgin. He has been active in the politics of the county, and is a man of considerable influence.

—Mr. F. B. James has been appointed Superintendent of the Detroit, Hillsdale & Indiana Railroad Company in place of Mr. D. L. Quirk, resigned.

—Mr. L. M. E. Stone has resigned the Superintendency of the Providence, Warren & Bristol Railroad Company, in order, it is said, to accept the Superintendency of the new road building from Hartford to Saybrook.

—Mr. J. B. Bausman, late City Engineer of Des Moines, Iowa, has been serving since the 1st of May as Chief Engineer of the Florida, Memphis & Columbia River Railroad and of the Southwestern Missouri Railroad, by which it is intended to connect Memphis with the Kansas Pacific near Fort Ellsworth.

—The directors of the Maryland Central Railroad Company have elected the following officers: President, William Gilmer; Secretary, George U. Porter; Treasurer, James Warden.

—At the annual meeting of the Shore Line Railroad Company, held in New Haven on the 19th ult., the following gentlemen were elected directors: Sereeno H. Scranton, Madison, Conn.; Simeon B. Chittenden, New York; Cornelius S. Bushnell, New Haven; Charles G. Landon, New York; Edward Ingraham, New Haven; James N. Townsend, East Haven, Conn., and A. N. Ramsdell, New London, Conn. Subsequently the following officers were chosen: Sereeno H. Scranton, President; Simeon B. Chittenden, Vice-President; Edward S. Scranton, Secretary, Treasurer and Transfer Agent. All these, both directors and officers, were re-elected. A dividend of 3½ per cent. was declared payable on Monday, July 3, 1871.

—The Legislature of New Hampshire has chosen David Gilchrist Railroad Commissioner of that State.

—The directors of the New Jersey Railroad & Transportation Company have elected the following officers: President, A. L. Dennis; Treasurer, H. J. Southmayd; Superintendent and Vice-President, F. W. Jackson; Secretary and General Passenger Agent, F. W. Rankin.

—On account of the increase in expenditure, labor on account of extensions, the Louisville & Nashville Railroad Company, on the 8th of April last, chose two Vice-Presidents—Judge Houston, First, and Albert Fink (late Superintendent), Second. Lately Judge Houston resigned his position, and Thomas J. Martin was chosen in his place. He discharges the duties of the President in his absence, while Mr. Fink has general charge of the construction of new lines, and the operation of completed ones. Judge Houston remains with the company as General Attorney.

—Governor Palmer has appointed as Directors of the Peoria, Altona & Decatur Railroad, under the provision of an act of the General Assembly in force April 16, 1869, John Waugh and A. M. Dill.

—The new directors of the Ottawa, Oswego & Fox River Valley Railroad are James F. Joy, of Detroit; James M. Walker, Robert Harris, Wirt Dexter and F. E. Hinkley, Chicago; B. C. Cook, Ottawa; Ralph Plumb, Streator; Elias A. Black, Yorkville; W. H. Miller, Aurora; William Reddick, Ottawa. Only one of these, Mr. Plumb, was a member of the old board which made the lease to the Chicago, Burlington & Quincy Company.

## PERSONAL.

—Henry Starring, of Chicago, is General Baggage Agent of the Pittsburgh, Port Wayne & Chicago Railway, the Erie & Pittsburgh, the Cleveland & Pittsburgh, the Grand Rapids & Indiana, the Chicago, Burlington & Quincy, the Burlington & Missouri River, the Hannibal & St. Joseph, and the Kansas City, St. Joseph & Council Bluffs roads.

—An Indianapolis telegram dated the 1st inst. says: "Harvey Elliott, the oldest railroad conductor running into this city, and for many years connected with the Indianapolis, Cincinnati & Lafayette Railroad, died quite suddenly yesterday, at Jacksonville, where he had gone to recruit his health, having just recovered from a severe spell of sickness."

—Hon. George Clark, President of the Newburg & Midland Railway Company, died at his residence in Newburg, N. Y., June 3d. He was fifty-three years of age at the time of his death, and had been one of the chief promoters of the railroad enterprise with which he was connected.

## MISCELLANEOUS.

—Chas. B. Ford has just recovered \$5,375 damages of the Fitchburg Railroad Company, for personal injuries received by the explosion of a locomotive of which he was engineer. The case, however, goes to the Supreme Court on exceptions.

—A decision of the Tennessee Supreme Court, declaring the warrants issued by the County Commissioners void, on the ground of unconstitutionality, will, it is said, affect the value of \$300,000 issued to the Mississippi River Railroad Company and held by McCombs & Co.

—The coroner's jury in the case of the Hallowell Railroad collision rendered a verdict that the accident was caused by the neglect of the conductor of the train, Charles Merrill, to observe the printed rules and regulations which govern the running of trains. Mr. Merrill, conductor, testified, very frankly and honestly, that it was his neglect that caused the accident; that he had some trouble with a passenger on board, who refused to pay his fare, causing him to forget that the train was not running on its usual time, and at Hallowell he signaled the engineer to proceed; he thought of the mistake an instant before the alarm was sounded.

—On the Central Pacific Railroad during the month of May last, there were 6,649 through passengers, of which 2,511 went eastward, and 4,138 westward. This business was exceeded only in the same month of last year, when 2,788 passengers moved eastward, and 4,062 westward over the road—a total of 6,850.

—The Dock Commissioners of New York have decided to begin at once the construction of a new pier, 500 feet long by 60 wide, at the foot of Fifty-seventh street, East River. The work will be under the supervision of General McClellan, and will be the first pier under the new system.

—Colonel A. B. Dull, of Pennsylvania, has been awarded the contract to complete the improvement of the Rock Island Rapids, his bid, \$202,000 being the lowest of six received by Colonel Maccomb.



## THE ILLINOIS &amp; ST. LOUIS BRIDGE.

Report of the Chief Engineer, October 1, 1870.

[Concluded from Page 158.]

## SUPERSTRUCTURE.

On the twenty-sixth day of February last a contract was made with the Keystone Bridge Company, of Pittsburgh, for the construction and erection of the superstructure of your bridge, including that of the approaches. By this contract the Keystone Bridge Company undertakes to furnish all materials at the same price per pound and per foot at which they were estimated in my published report of May, 1868, excepting cast steel work, which is to be furnished at \$30 per ton less than the cost set forth in that report. There will be about 2,500 tons of steel used, therefore the saving on this item will amount to about \$50,000. The contracting party will, however, receive \$40,000 more for erecting the three spans than the estimate in the report. Every other item of cost, as set forth in the report referred to, is the price per pound or foot to be paid the Keystone Bridge Company. The amounts set forth under the head of engineering and contingencies, in that report, and aggregating \$149,512.14, for superstructure of bridge and approaches, are reserved by your company, and will be ample to cover any excess of materials required over the amounts estimated, and for engineering expenses, etc.

By the terms of the contract with the Keystone Bridge Company, it agrees, under a severe forfeiture in case of failure, to complete the structure ready for use in all its parts in seventeen months from the time working drawings were furnished to it; provided it is not delayed by masonry work after the first of March next. In case of such delay, the time of completion is to be extended no longer than the time it is so delayed. Completed working drawings were not furnished until the first of July, as the completion of certain parts of them was dependent upon data that were obtained from the testing machine, and which could not be ascertained at an earlier period. This delivery of drawings fixes the time for completion of the bridge on the first of December of next year. I have no apprehensions that the masonry will not be completed in season to prevent any claim for an extension of time on the part of the Keystone Bridge Company.

I have been informed that the Keystone Bridge Company has contracted with the Wm. Butcher Steel Works Company, of Philadelphia, to furnish the cast-steel that will be required in the work.

Specifications for the cast steel work will be found in the appendix to this report.

I have tested so many samples of steel made by this company which surpassed in strength the requirements set forth in these specifications, that I have no fear of its not being able to supply the quality required. Several pieces of this steel have shown limits of elastic reaction ranging from 70,000 to 93,000 pounds per square inch.

Since my report, 1st May, 1868, in which the plan of superstructure was described, I have made several modifications in the general arrangement of the arches and in the details of their construction, which will considerably improve the architectural appearance of the bridge and simplify its fabrication.

These changes consist mainly in using but one cast-steel tube of eighteen inches diameter, instead of two of nine inches, in forming the upper and lower members of each one of the four ribbed arches composing each span; and in increasing the depth of each one of the arches from eight feet to twelve feet from center to center of these tubes.

The railways (which are below the roadway) are raised four feet, so that in no place will they appear below the arches, as they did in the original design. In that design the railways were eight feet lower than the center of the middle span. By deepening the arch four feet and raising the tracks four feet, they are brought level with the center of this span, or above the soffit of the arch. The lower ribs or tubes of the arches spring from the piers at their original level, consequently the arch has four feet less versed sine or rise than before. To lessen the grade of the railways it was necessary that the tracks should descend each way from the center of the middle span. This would cause them to fall below the centers of the side spans, to avoid which the level of the springing of these two spans has been lowered eighteen inches at each abutment. That is, the ends of the arches of the side spans, resting against the abutment piers, will be eighteen inches lower than the other ends, which rest against the channel piers. These arches, like the central ones, have four feet less rise than as originally designed, and by lowering their shore ends, as stated, an additional gain of nine inches depression is obtained at their centers, by which the gradients of the tracks are proportionately lessened towards the ends of the bridge.

Raising the tracks to the height of the centers of the arches will unquestionably improve the appearance of the structure, and it is generally conceded that the alteration in the level of the springing of the shore ends of the side spans is likewise an architectural improvement. The effect upon the eye caused by it will be somewhat similar to that produced by the camber of the bridge.

Of course these changes involved the necessity of revising the former investigations and results, so as to ascertain the difference in the strains, and to determine the alterations required in the sectional areas of the various members of the structure, when thus modified. An entirely new set of detail and general drawings were likewise required in consequence of these changes.

The lithographic view of the bridge in the appendix is a very correct representation of the structure as it has been definitely determined upon, and is now being constructed. This view also shows the depth of the bed rock at the site of the different piers, and the depth of sand overlying it during ordinary stages of water.

## CONDEMNATION OF LAND FOR APPROACHES.

Since my last printed report, the land required in Illinois for the eastern approach to the bridge has been obtained by condemnation, and paid for by the company.

Judicial proceedings have been commenced in this State for the condemnation of the requisite ground for the approach on this side of the river. About one-fifth part of that which will be required has already been obtained by purchase. A commission has been appointed by the court to fix the values upon the remaining pieces wanted. No delay in obtaining possession of all the land required is anticipated. These matters are entirely under the control and in the charge of the Executive Committee.

## WIDENING THE AVENUES TO THE BRIDGE.

During the last session of the General Assembly of the State of Missouri, a law was passed requiring an election to be held by the citizens of St. Louis, to decide upon the question of taxing the city with a sum not exceeding \$500,000, to defray the cost of widening the streets leading directly to the bridge. This election was decided affirmatively by a very handsome majority. Steps have already been taken by the Mayor of St. Louis, Hon. Nathan Cole, to carry the will of the people, thus expressed, into effect.

Washington avenue is the most centrally located avenue in St. Louis, and is also one of the most beautiful. It runs nearly in the direction of the bridge, which is located at its eastern terminus. By the bridge this avenue is virtually extended across the Mississippi River into the State of Illinois.

The law referred to requires this avenue, which is eighty feet wide, to be widened at Third street, where the roadway of the bridge begins, to one hundred and forty feet, and at Fourth street to one hundred and seventeen feet.

Third street, which is intersected by the roadway of the bridge, is at this point only sixty feet wide, and immediately south of the bridge it is only thirty-eight feet wide. The law contemplates the condemnation of the fronts of seven blocks on this street, three on one side and four on the other side, so that it will be one hundred and sixteen feet wide at the bridge. This width will be maintained throughout two blocks north and one block south of the bridge. From this latter point it will be gradually narrowed from one hundred and sixteen feet to seventy-six feet, in the length of the second block south. Thence south, Third street is but forty or fifty feet wide. The widening of Washington avenue will, however, afford easy access to Fourth street, which extends southwardly from the bridge a mile or more in one uninterrupted width of eighty feet, by which the southern travel will be conveniently accommodated. North of the bridge, Third street, or Broadway, as it is called, will afford one grand highway, one hundred feet wide, to the northern limits of the city.

These improvements will no doubt be completed by the city authorities as soon as the bridge is finished. They will contribute greatly to the appearance and beauty of it, and will vastly promote the convenience of the public. The wisdom and liberality of those who voted in favor of providing these magnificent highways to accommodate the vast tides of travel that will hereafter flow to and from the bridge, will be more fully appreciated when the structure is completed.

## CHANGES IN THE BED OF THE RIVER.

I think the propriety of placing the channel piers of the bridge upon the bed-rock can be no longer questioned, if we consider the facts developed in sinking them. The remarkable scour of fifty-one feet below low water line made in the bed of the stream at the east pier, by the freshet of last April, is sufficient to prove that the scour extends much deeper than was supposed to be possible by many distinguished engineers. The depth of scour was assumed by them as never exceeding thirty feet below low water mark. At more than twice this distance below low water mark (sixty-six feet), pieces of bituminous coal, as large as a coco-nut, were found imbedded in the sand at the site of the east pier. This coal had evidently been mined by man, and had not been carried any great distance by the current, as its surfaces were brilliant, and the angles which had been formed by fracture were sharp and perfect. From these facts it would seem evident that the coal must have been carried by the current to where it was found, after the era of steam navigation, as we have no knowledge of stone coal having been used on the Mississippi before that period. These pieces of coal had doubtless been lost from some steamer navigating the river above the city, and lodged where they were found during a deep scour, resulting from some unusual current acting upon the bed of the stream. These currents, I am convinced, extend to a greater depth in the winter season than in time of floods, which occur in the spring and early in the summer.

The channel opposite this city is very narrow and during severe winters it usually freezes over very firmly before many wider places above are closed. From these open parts floes and fields of ice float down and are driven under the fixed and frozen crust at this point. The floating ice, being lighter than the water, occupies the part of the channel immediately beneath the frozen crust and there stops, and as this engorgement in the narrow channel is increased by constant accessions from above, the current must be gradually forced deeper and deeper. In this way it is not at all improbable that where these gorges occur in the river its sand deposit may be totally removed in mid-channel, and the bed-rock exposed to the action of the current. When this occurs, a continuance of the supply of floating ice soon chokes the passage of the water between the rock and the gorged ice, and thus a natural dam is created across the stream. Sudden rises of the river above these gorges, attaining in a few hours several feet in height, are not at all unusual on the Missouri and Mississippi during severe winters. When they occur, the immense pressure of the water finally sweeps away the obstruction, and fills the open space in the river below, for miles distant, with ice so discolored with river sediment as to be scarcely capable of flotation, and giving ample evidence of its imprisonment beneath the surface.

Colonel Roberts found a bone in the sand within a foot or two of the bed-rock, under the east pier. It is a part of the femur or thigh-bone of an animal larger than man, and is not petrified; from which fact I assume that it could not, probably, have been in the place where it was found during any long period of time.

While on this subject I will state, as an interesting geological fact that a piece of the bed-rock was broken off in which is found a considerable amount of white coral. It appears on the surface of the piece, which is about three inches thick and extends through it, appearing on the lower or fractured side. The walls of the cells are incrustated with quartz, the crystals of which are so minute that they can only be seen through a lens.

Beneath the west pier logs partly charred were met with at the depth of fifty feet below low-water mark. During the last pumping of sand from the east air-chamber, eighty-four feet below low-water mark, particles of charcoal were constantly discharged from the pumps with the sand.

The bed-rock was found to be of dark-colored limestone or marble of such close texture as to admit of a moderate degree of polish. Its surface was worn smooth and covered with corrugations of from three to six inches in size, evidently proving that it had been exposed to the direct and constant action of the current, probably at some very remote period.

## THE ICE-BREAKERS.

The lateness of the season when the sinking of the east pier commenced made it absolutely necessary to provide some adequate protection for the requisite boats, machinery, etc., at the site of the pier, against the heavy floating ice which invariably makes its appearance here during the winter. This floating ice frequently attains a thickness of ten or twelve inches, and often covers the entire surface of the river, moving along at the rate of about three or three and a half miles per hour. In proportion as the weather becomes more intensely cold, the volume of the ice increases and the rate of its movement decreases, until it finally comes to a full stop and then quickly freezes over, affording, even within a few hours afterwards, a safe highway across for pedestrians. In a day or two later the frozen mass becomes so strong as to support the largest and most heavily loaded wagons.

The freezing over of the river at St. Louis is not, however, an invariable rule, as it does not occur, perhaps, oftener than three in every four years on an average. Last winter was fortunately an exception to the rule. For several days, however the floating ice was so heavy and compact that it was with the utmost difficulty that the most powerful steam ferry boats, built expressly to meet such contingencies, could force a passage through it, one or two trips across during an entire day being all that they could accomplish, frequent attempts in the meantime proving abortive.

To establish in mid-channel any temporary works to withstand an element so apparently resistless, and of such ex-

haustless volume, was an untried experiment on the Mississippi that presented several very discouraging features. The two chief difficulties were first, to place any construction above the pier that would not be quickly scoured out by the current, and second, to make such construction so strong as to resist the power of the ice to sweep it away. The method devised by me to accomplish the desired result will be fully understood by the following description.

About two hundred feet above the pier, at a point from whence the current would flow to the center of the pier, a pile was driven which formed the apex of a triangular system of piles shaped like the letter A. From this pile two lines of other piles were driven at distances of eight feet. These two lines extended down stream to the distance of 200 feet and represented the two sides of the letter A. At their lower extremities these two sides were about 180 feet distant from each other. The triangle thus formed was filled in with other piles driven in transverse lines from side to side at distances of about fourteen feet, and the tops of the entire system were then thoroughly braced together with hewn oak timbers ten by ten inches square, well bolted to the piles, which were of cypress.

The water was from forty to forty-seven feet deep, when this part of the work was executed, and many of the piles were washed up as the work progressed. It was difficult to drive them into the sand more than twenty feet deep, even with a steam pile driver of 3,500 pounds weight.

About fifty feet above this triangle was placed a clump of nine piles driven close together, and this was encased in sheet iron throughout about twelve feet of its length to prevent the ice cutting the piles. About one hundred and fifty feet above this clump of piles, a large iron pile, made of the shell of an old cylindrical steam boiler five-sixteenths of an inch thick, twenty-eight feet long, and forty-two inches in diameter, was sunk nearly to its full length into the sand vertically. From the middle of this iron pile, twelve feet below the river bed, was attached before sinking, a wire cable of one and seven-eighths inches in diameter. This cable was led over the clump of piles and firmly secured to it, and from thence it was carried down to the apex of the triangular system below, where it was hauled taut and securely fastened. The object of the rope was to aid in holding the piles steady until the entire protective system was completed; and also to form a cutting edge on which the large floes of ice could be raised and broken asunder before striking the works below. To the triangular system of piles the calson was secured, and was held by it against the current until it entered the sand.

The iron pile was open through six feet of its lower part to form a sand chamber into which one of the sand pumps was introduced to withdraw the sand and permit it to sink. Above this chamber the pile was filled with ore from the Iron Mountain of Missouri, to insure its sinking in the sand. A central tube, fourteen inches in diameter, made of an old boiler flue, enabled the sand pump to be passed through the pile to the sand chamber at the bottom, the ore being contained in the annular space surrounding this tube. The water was about thirty-five feet deep at the site of this pile when it was sunk. After its lower end had penetrated to a point about sixty-two feet below the surface of the water, and the cable had been tightly stretched, fifty or sixty cubic yards of large rubble stone were thrown in around the pile to protect it from scour.

After this work had progressed thus far, a subsidence of about ten feet in the river enabled us to bolt on to each side of the triangle of piles, about ten feet below their tops, a longitudinal timber about ten inches square, running the entire length of the system. These two longitudinal timbers, placed near the surface of the water and well secured to the sides of the triangle, constituted hinges by which two enormous ice aprons were attached, one on each side, to the triangle.

The object of these aprons, which will be presently described, was to present an inclined surface on each side of the triangle of piles on which the impact of the ice could be received. Any obstruction opposing a vertical surface to the action of the ice would be soon crushed to pieces or ground away, whereas by presenting an inclined one, the ice would slide upon it and be broken to pieces, and be thus made to pass off harmless from it, just as the soil does from the plowshare and mold-board.

To protect the piles from the scouring action of the current, it was necessary to provide some means of keeping the current from them. To do this with broken stone would be very expensive, as well as unreliable, and would, besides, create an obstruction much larger than the pier, which would be difficult and costly to remove after the masonry was completed. By planking the ice-aprons down their inclined sides to the very bottom of the river, the current could be deflected by them from the piles below, and the ice from them above, and thus both objects be attained. This was done.

The ice-aprons were 200 feet long and sixty feet wide. It was necessary to place them beneath the water at an angle of forty-five degrees, and with the lower edge or side of each resting on the sand, and to make them of such strength as not only to resist a powerful current, but also to withstand the great pressure of the ice, which might, by the fluctuations of the stream, be made to impinge as low down on their sides as to the middle of their surfaces, as well as at twelve or fifteen feet above that point.

The frames of the aprons were made of strong squared oak timber placed transversely at intervals of eight feet, so that the upper end of each one of them would rest by the side of a pile, and on the longitudinal timbers before mentioned. The transverse timbers were each sixty feet long, and were held in place by three equidistant string-pieces, each 200 feet long, bolted beneath them. Two of these skeleton frames were thus constructed on shore, above the works, and were launched with sufficient pine timber beneath to float them. They were then towed, one to each side of the pile structure, and the end of each transverse timber on the side next the piles was placed on the longitudinal timber or hinge before named, and secured temporarily to them by chains. The outer edges of these frames were then secured to barges placed alongside of them, and the pine floats under the frames were then taken out. In this position, as the two frames lay on the water, they were planked with three-inch oak plank. On that part where the ice was expected to impinge, No. 16 sheet-iron was placed over the planking. A space on each apron about twelve feet wide, and extending their entire length, was thus covered with iron. Below this iron covering some openings were left through the aprons for the current to pass, to prevent the formation of a bar of sand below the structure, in the eddy that would be created by the ice-aprons, after they should be in place.

When the aprons were both completed, the lines holding up their outside edges at the barges were simultaneously cut away; these edges then quickly disappeared beneath the current and were swept by it to the bottom. Both aprons assumed the desired angle. The upper extremities of the transverse timbers forming them then rested on the longitudinal timbers, forming the hinge by which their lower ends were rotated down to the bed of the stream. The upper ends of these transverse timbers were then each bolted to its respective pile, and that portion of the sides of the pile system extending vertically above the aprons was planked with two or three strakes of ten by ten oak timber, at the part nearest the aprons, and above that point with lighter oak plank. At



the apex of the breakwater thus formed, about 150 cubic yards of rubble stone were thrown in, to thoroughly close any space left between the upper ends of the two aprons.

This structure sufficed to completely turn the ice during the winter, and made a thorough protection to the works and barges about the pier. A deposit of sand rapidly formed behind the ice-aprons, which gave great support to them, whilst they in turn protected this deposit, once formed, from the action of the current.

Before our magnetic telegraph was erected, the ice was so heavy for several days as to completely suspend intercourse between the workmen at the pier and the shore. This contingency had been provided for by provisioning the men with two weeks' rations and providing them with bedding.

During the greatest severity of the ice, Mr. McComas, who remained at the pier, continued to operate the sand-pumps, and every morning and evening reported the progress of the work in a conspicuous place, and in characters so large as to be read by telescope from the shore. The closing sentence of the report was, constantly, "Ice-breaker all right."

This structure was duplicated at the west pier with equally successful results. Both ice-breakers are still standing, having successfully withstood the April flood, which attained a height of twenty-six and a half feet above low-water mark; and although the current is much increased by them and the river scoured out in proportion, the original angles assumed by the aprons seem to be almost entirely unaltered.

#### CONCLUSION.

I avail myself of this opportunity to express my thanks to the several gentlemen assisting me in the various departments of the engineer and construction corps of the bridge, and to commend them to the kind consideration of the company, for the faithful and efficient discharge of the important duties assigned them.

Respectfully submitted,  
JAMES B. EADS, Chief Engineer.

#### APPENDIX.

##### SPECIFICATIONS FOR CAST-STEEL WORK.

The steel shall be of the kind known in commerce as crucible cast steel. It will be required to stand the following tests; and failure to stand any one of such tests will be sufficient cause for the rejection of the piece.

The staves composing the tubes will be required to stand a compressive strain of sixty thousand pounds and a tensile strain of 40,000 pounds per square inch of section, without permanent set.

They must stand a tensile strain of 100,000 pounds per square inch without fracture.

The modulus of elasticity shall not be less than 26,000,000 nor more than 30,000,000 pounds. This variation should be avoided if possible; in which case the lower amount will be preferable. If a variation occurs in the modulus, bars having the same modulus must be selected in making up the tubes, so that one side of a tube shall not have a greater power of resistance than the opposite one. Those having the same modulus shall be placed in the same tube. Each bar will be tested by the contractor, and the modulus stamped on it by the Illinois & St. Louis Bridge Company's Inspector.

The steel pins will be required to stand, without permanent set, a tensile strain of 40,000 pounds per square inch and an ultimate tensile strain, without fracture, of 100,000 pounds. As it will be inconvenient to test these pieces, the Engineer will require to have two or more of them made in one piece, and of sufficient length to cut from the middle or ends of the piece a sample for testing. In such case, failure of the sample will cause the rejection of the entire piece.

Rods, bolts, eye washers, rivets, etc., will be required to bear an ultimate tensile strain of 100,000 pounds per square inch without fracture, and 40,000 pounds per square inch without permanent set; such parts of the work will not be tested in tension beyond 40,000 pounds, sample pieces only being subjected to ultimate tests. Such tests as in the judgment of the Engineer or Inspector may be necessary to detect flaws or other imperfections, when the pieces cannot be conveniently subjected to trial in the testing machine, may be used, and any flaw or other imperfection existing in any piece, will be sufficient cause for its rejection, if in the opinion of the Engineer or Inspector it is injured thereby.

The one-quarter inch plate steel for enveloping the staves will be required to have a resistance to compression and tension, without set, equal to 40,000 pounds per square inch, and an ultimate tensile strength of 100,000 pounds.

The staves must be so accurately formed that when six short sections of the same bar two inches in length are bound together by an elastic hoop, they will fit accurately at the joints, and form a true circle  $17\frac{1}{2}$  inches outside diameter. They must be as straight as it is possible to make them, without planing them.

Steel templates will be provided by the contractor, under the direction of the Engineer, and will be verified and stamped by the Engineer before being used. The various parts of the work must be made to fit these templates with the greatest attainable accuracy, and it will be the duty of the Inspector to reject any piece which in size and direction of its parts shows the least imperfection.

All holes through the steel work must be drilled, and all bolts turned, unless otherwise directed by the Inspector, in writing. Wrought-iron bands on tubes must be turned on the inside, and faced on each edge, as shown in drawings, and must be heated and shrunk on.

The steel pins will be accurately finished according to the drawings. The central part, where it is reduced in size, will not require turning off. The conical portions must be large enough to fill tightly the holes in the tube couplings. The couplings for tubes may be of rolled steel. The portions next to the main braces of the arch must be true and parallel, to insure accurate contact and adjustment of the braces to them; but these surfaces and the outside of the couplings need not be finished work.

The surface of these pieces coming in contact with each other, or in contact with all other parts of the work, except the main braces must be accurately finished.

Pieces of the material of these couplings will be subjected to the same test as the pins.

Only the six bolts nearest the center of tubes, extending through and through, are to be put into them before erection. The caulking of the iron bands on the tubes and the remainder of the through bolts, must be put in after the superstructure is erected. Four  $1\frac{1}{2}$ -inch steel bolts will pass through the ends of each set of main braces, and will be tapped into the tube couplings. The work must also be done after erection of superstructure; the object of these bolts being to prevent any movement of the braces around the pins and of the braces on each other.

The tube envelopes must have their edges planed and brought closely together to insure accuracy of diameter of the tubes before riveting on the butt straps. These latter will be caulked.

Each piece, after being examined and accepted by the Inspector, is to be covered with a coating of paint, or other material, as may be directed by the Inspector, to prevent rusting.

—Mr. William G. Peck has been appointed Superintendent of the Vineland Railway, of New Jersey, and entered upon his duties the 22d ult.

#### The Narrow Gauge.

The following is a letter signed "S.," dated at Philadelphia, and addressed to Samuel Wilkenson, Secretary of the Northern Pacific Railroad Company, which we find in the New York Tribune. We make some comments on it on our editorial page:

The subject of railways with gauges narrower than the present standard has already, in this country, become of very great importance, and many professional and amateur engineers have rushed into print with statistics to show the immense superiority of such roads, in economy of construction and actual carrying capacity. It has been reserved for the Denver & Rio Grande Railway to demonstrate, practically, how much economy is effected, and in what manner it is proposed, and to make their road, constructed on the three-foot gauge, as efficient, in point of carrying capacity, as roads of standard gauges as at present conducted.

While the discussion has proceeded in papers, magazines and pamphlets, the builders of the Denver & Rio Grande line have been steadily at work, until now the first eighty miles of the line is graded, bridged and tied; rolling stock completed, and nothing but the perverse delays in the arrival of the iron hinders the completion of the road and its opening for traffic.

The construction and capacity of this rolling stock alone furnish the solution of these two questions of economy and capacity, and the statistics below given will prove of very great interest to every one who knows what a railways is.

The engines adopted for this gauge are of the same patterns as the standard engines in use on the Pennsylvania Railroad, with but slight modifications, and were adopted after a careful comparison of those in use on both foreign and home roads.

The passenger engines have four driving-wheels of 36 inches diameter, and one pair leading-wheels; cylinders, 9x16 inches; weight on drivers, with water in the boilers, 20,000 pounds; total weight, 25,000 pounds. A four-wheeled tender accompanies it, weighing 15,000 pounds empty.

Freight engines have six driving-wheels, 36 inches diameter, with one pair of leading wheels; cylinders, 10x16 inches; weight on drivers, 25,000 pounds, and a total weight of 30,000 pounds. Tender weighs 15,000 pounds empty.

In the construction of passenger cars there has been, perhaps, too much deference paid to prejudices in favor of existing patterns to obtain the full benefit of the narrow gauge system. These cars have the following dimensions: Length, 35 feet; length, including platform, 40 feet; height inside to center of dome, 7 feet 9 inches; diameter of wheel, 24 inches; height of floor-beams above rail, 27 inches; capacity, 35 passengers. These cars are handsomely finished in the style of the Pullman car, and give the same seating room as the cars of the Pennsylvania road. They are thoroughly ventilated and comfortable, and are eight-wheeled, with an arrangement of springs which makes them very easy on track. Their weight is 16,000 pounds. Freight cars are made of present patterns, but are four-wheeled. They weigh but 4,000 pounds, while having a capacity of 10,000 pounds.

This is but a short and imperfect description of this rolling stock, but is necessary to a ready comprehension of results given below—results based on actual comparison of actual power of engines, and actual weights of rolling stock on the 3-foot and 4-foot  $8\frac{1}{2}$ -inch gauges respectively.

We have taken the Pennsylvania Railroad for purposes of this illustration, because it is ably managed and near at hand. The standard passenger engine in use on that road has a weight on drivers of 40,000 pounds, or just double the capacity of the engine on the Denver & Rio Grande, but has a total weight, including tender, of 105,000 pounds, or 52½ tons.

Their usual local passenger train consists of:

	Tons.
4 passenger cars, seating 53 passengers each, and weighing each 40,000 pounds, or 20 tons	80
1 baggage car	14
1 engine and tender	62½
Total	146½

This train will accommodate 212 passengers, if full. To carry the same number of passengers on the 3-foot gauge, we require:

	Tons.
6 passenger cars, seating each 35 passengers, and each weighing 8 tons	48
1 baggage car	4
1 engine and tender	20
Total weight	72

or less than one-half the total weight of the train on the standard gauge. Then, since the smaller engine has one-half the power of the larger, it follows that it can readily take its load wherever the larger engine can go; and, on the authority of M. Baird & Co., who, from their long experience may certainly be considered trustworthy in such matters, can take it at a speed of 36 miles per hour as readily as the other can run 40 miles per hour.

But follow this out in freight traffic, which is the paying traffic of any road, and see the result.

The capacity of the freight engine on

	Tons.
Three-foot gauge is, on average low grades	406
Deduct cost of engine and tender	22½
Leaving for load	383½
Cars weigh 2 tons to carry 5 tons of this load then 2½ would be cars, or say	108
Leaving for paying freight	275
On standard gauges freight engines having double the weight on drivers will have double the capacity, or	550
Deduct engine and tender	60
Leaving for load	490
Cars weigh 10 tons and carry 10 tons, then of load one-half will be weight of cars	375
Leaving for paying freight	115

This shows an actual capacity for the narrow-gauge freight engines of nearly three-fourths that of an engine of more than 2½ times its weight.

But we have supposed, in this case, that cars on both gauges are always filled, which, unfortunately, is far from being the case. Statistics show that on the standard gauges more than four tons of dead or non-paying weight are annually carried over these roads to each ton of paying freight. In other words, the average amount of freight carried in each car is but one-fourth of its capacity. Allowing that this discrepancy may extend to the three-foot gauge also, which, from the smaller size of cars, can scarcely be expected, and this is the result:

3-FOOT GAUGE.	Tons.
Cars weigh 2 tons, and have capacity of	5
Then in load as above of	383½
There will be weight of cars	224
Leaving weight of paying freight	146

4 FEET $8\frac{1}{2}$ -INCH GAUGE.	Tons.
In loads as above of	750
Weight of cars	600
Weight of freight	150
or only 4 tons more than on the narrow gauge.	

This then is the practical result of the narrow-gauge theory, and from this follow naturally all the principles of economy in construction and operation, cheap freights, large dividends, its adaptability to other than mountainous countries, the feasibility of doubling the number of miles of our railway systems at no more than former outlay, the easy development of sparsely settled but valuable districts, and all the long train of advantages which will accrue to the stockholders of such paying roads as well as to the people along their routes.

#### The Vanderbilt Railroad Depot in New York.

The great railroad depot erected by Commodore Vanderbilt at Forty-second street, is at last completed and ready for its occupants. This building fills a want long felt by New Yorkers, aside from which it is a magnificent ornament to the city, and will doubtless prove a lasting monument to its builder. New York can now boast of the largest railroad depot in the country, and her railroad men will now no longer be compelled to transact their business in the little, low, and inconvenient enclosures at Twenty-sixth, Twenty-seventh and Thirtieth streets. The new edifice is designed for the accommodation of all the roads that have a terminus in the city, and is provided with the necessary waiting rooms and ticket offices for the different passengers, as well as the lines of tracks for the various trains. The building proper, which extends from Forty-second to Forty-fifth street, is 692 feet in length and 240 in width. The materials used are smooth red brick and iron painted white. The front, or principal elevation, is on Forty-second street, and rears its magnificent proportions high in the air, presenting a most imposing appearance. The center of the facade is covered with a tower 130 feet in height, and flanked at each end by towers 110 feet high. The west elevation, as seen from the new street formed by the depot, exhibits similar features, and is surmounted by three towers 110 feet in height. The north end is constructed entirely of iron, and has ten huge iron arches for the ingress and egress of trains; while the eastern side, which is the least imposing, is for the most part built of brick, and will be used chiefly for the freight department. On the south side, fronting on Forty-second street, the whole width of the building, to the depth of forty feet, and to the height of three stories, is devoted to the waiting-rooms and offices of the New York & New Haven Railroad. On the ground floor there is, first of all, an ample baggage-room; next, the gentlemen's waiting-room; and that for ladies. These rooms are handsomely fitted up in black walnut and oak, and supplied with every convenience. Adjoining the ladies' waiting-room is the ladies' dressing-room, which is furnished with all the modern conveniences, and is a model of elegance and luxury. On the second floor are the offices of the Superintendent, the stationery and store-rooms, the Chief Clerk, Treasurer, Attorney, President, and the Directors. On the third floor are the conductor's room, store-room for tickets, general ticket office, printing-room, and five small offices for undetermined purpose. The west side of the building, for its entire length, to the same depth and height as on the south side, is similarly designed for the business and traffic purposes for the New York & Harlem Railroad, the Hudson River Railroad, and the New York Central Railroad. In this way the west and south end, to the depth of forty feet, are occupied solely by offices, and the central space, 650 feet by 200, forms a monstrous car house, to which admission is gained by the ten iron arches at the north end of the building. The height of this immense car-house is ninety feet. The roof is formed of glass and corrugated iron, and is supported by thirty-one semi-circular trusses of iron, each measuring four feet in width by one foot in thickness. These trusses are painted in rich colors, and on the lower sections there is a good deal of gilding, while the iron sheeting extending between the arches is painted a blue tinge. The effect of the whole is perfectly gorgeous. At night the interior is lighted up by twelve chandeliers, each provided with one hundred lights and a large reflector. High up on the walls, in letters six feet high, are inscribed the names, "C. Vanderbilt, President; W. H. Vanderbilt, Treasurer." There are twelve lines of railway running the entire length of this stupendous shed, divided into groups of two or three by raised platforms, composed of stone and cement, for the accommodation of the four lines which start from the Union Depot. At the southeast corner of the building, at the junction of Fourth Avenue and Forty-second street, are two lines of railroad, which form the terminus of the Fourth Avenue Railroad, by which passengers will be enabled to step on board the steam cars from the street cars without exposure to the weather.—New York World, June 30.